ENCYCLOPEDIA OF KEYBOARD INSTRUMENTS

The Organ

AN ENCYCLOPEDIA

EDITED BY

DOUGLAS E. BUSH AND RICHARD KASSEL

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Douglas E. Bush, Editor
Richard Kassel, Associate Editor

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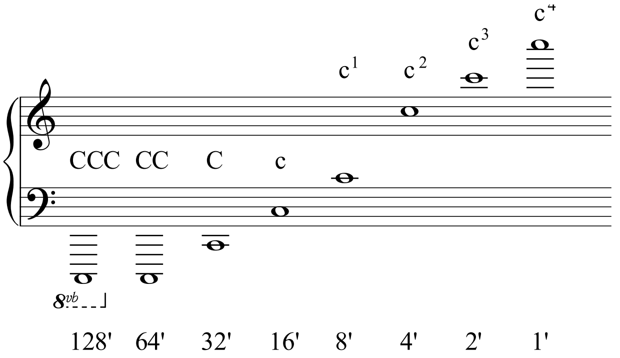
Introduction

This book employs standard ways of indicating 1) pitch, and 2) the elements of a particular organ.

Pitch The system used to indicate different octaves (registers) is as follows:
The notes on the staff may be referred to by octave (multiple uppercase letters for lower registers; lowercase letters with superscripts for higher registers) or by pipe lengths (by feet). Ascending from any note C, the octave retains the same register indication (for example: c^1 d^1 e^1 f^1 g^1 a^1 b^1 c^2 d^2 . . . etc.).



"Pipe length" is an approximation of the length of pipes associated with a particular register; in some cases, a pipe has been altered to produce a pitch an octave higher or lower than what its length would usually produce.

The c^1 (middle C) on the modern organ is considered to be "based" on 8' (c^1 = 256Hz = cycles per second, the "frequency"). Before the nineteenth century, organs in the Medieval and Renaissance periods (including positives and portatives) and smaller organs in the Baroque (and Rococo and Classical) era used 4' (c^1 = 128Hz). By the time of the Romantic organ, 8' was the norm.

To summarize the alignment of pitch and pipe length:

Pitch:	CCC	CC	C	c	c'	c''	c'''	c''''
Pipe length:	128'	64'	32'	16'	8'	4'	2'	1'

Elements The shared components of organs are: its location, including city and name of church or venue, if available; the builder, if not already given; when the organ was newly built—or, if the builder was rebuilding or incorporating an older instrument, when it was originally built and by whom, and when the rebuilding occurred; the number of keyboards (manuals); the number of stops (ranks when indicated); the presence or absence of a pedalboard, or the use of pull-down pedals; whether an instrument was later rebuilt, enlarged, restored, reconstructed, incorporated into another instrument, replaced, dismantled, lost, or destroyed; if the organ still existed, any change in keyboards and stops; and the type of action employed. Sometimes an unusual aspect of the organ is mentioned.

Manuals, stops, and pedalboard are indicated as follows:

no. of manuals/no. of stops	[pedalboard present]
manuals/stops/pull-down	[pull-down pedals present]
manuals/stops/no pedal	

Examples taken from the book:

[Casparini] Görlitz, St. Peter and St. Paul, “Sonnenorgel” (1697–1703; case survives)

[Hutchings] Bellows Falls, Vermont, United Church, 1883 (2/15, mech.; rest. S.J. Russell, 1984)

[Reil] Joure, Gereformeerde Kerk De Oerdracht, 1997, 2/25 (repl. 1968 Reil [destr. by fire, 1994])

[Andreas Silbermann] Colmar, St. Matthieu (1732; 3/24; reb. Stiehr, 1861; rest. Dott, 1995–98, to 1861 state; now 3/38)

[Bernard Smith] Edam, Cathedral (1663; reb. Verhoufstad, 1716; 2/15/pull-down)

Abbreviations

Abbreviation	Equivalent
anon.	anonymous
b.	born
ca.	circa
chris.	christened/baptized
collab.	collaborated with
compl.	completed [by]
d.	died
destr.	destroyed
dism.	dismantled
ed.	edited, editor/s
electro-pneum.	electro-pneumatic [action]
enl.	enlarged [by]
fl.	flourished
incorp.	incorporated [by; into]
mech.	mechanical [action]
mech./electric	mechanical/electric [actions; both being employed in one instrument]
orig.	originally
pneum.	pneumatic [action]
reb.	rebuilt; renovated; altered
reconstr.	reconstructed
repl.	replaced [by]
rest.	restored [by]
tub.	tubular [action]
tub./pneum.	tubular/pneumatic [actions; both being employed in one instrument]

A

ABBEY, JOHN (YORK) (1783–1859)

English-born French organ builder. Born in Whilton, Northamptonshire, on 22 December 1783, Abbey apprenticed to James Davis. He subsequently entered into partnership with Hugh Russell (b. London, ca. 1731; d. 1825), who had previously worked with John England. In London, he met Sébastian Erard; this led to an invitation to build an organ for the Louvre Industrial Exhibition (Paris, 1827; to Paris Conservatory by 1864). Abbey settled permanently in Paris, where he fulfilled royal commissions for the chapel of the Legion of Honor at St. Denis; the chapel of the Tuileries (1827–29; severely damaged during 1830 revolution); and the Opera (1831; destr. by fire, 1873). These instruments introduced France to free reeds, the Cummings inverted-rib bellows, Venetian swell, the Dulciana stop (originally brought to England by John Snetzler), and the hitch-down drawstop pedal. Abbey's small chancel organ at Paris, St.-Étienne-a-Mont (1829), initiated the French accompanimental *orgue du choer* tradition as a counterpart to the main west end instrument. Abbey subsequently built large gallery organs at Amiens Cathedral (1833), Tulle (1839 exhibition, first prize), Bayeux (1843), Viviers, and Châlons-sur-Marne (last two survive in orig. form). He built smaller gallery or chancel organs for Versailles Cathedral (1837) and the hospital chapel, Houdan, Neauphle-le-Château (1845), and, in Paris, chancel organs at St. Nicolas-des-Champs, St. Elisabeth, St. Thomas d'Aquin, and St. Médard. He also restored cathedral organs at Mende (1835–39), Rheims (1844), Evreux, Moulins, and Nevers, as well as St.-Étienne-du-Mont, St. Philippe-du-Roule (1834), and Notre Dame de l'Assomption, all in Paris.

Abbey's organs were highly reputed for their overall excellence of craftsmanship, responsive action, and fine voicing. They featured composition pedals, string stops, adjustable action, and backfalls. His work effected a transition from French classical to Romantic, and his only competitor was Aristide Cavaillé-Coll (who won a contract for St. Denis's new organ over Abbey in 1833). Abbey exported instruments as far away as South America; he trained Joseph Casavant as well as his own sons John Albert Abbey (1843–1930) and Edwin Abbey (1840–1895), who continued their father's firm after his death in Versailles on 19 February 1859. Edwin's son John-Marie Abbey (1886–1931) was the last builder in the family, and the firm closed in 1935.

Richard Kassel

ABBOTT AND SIEKER

Formed in 1961 by Richard Laurence (Larry) Abbott and Uwe (Pete) Sieker, the firm of Abbott and Sieker continued in operation until 1994. Larry Abbott (b. Pomona, CA, 24 July 1925; d. Santa Monica, CA, 29 July 2001) graduated from Pomona College in organ and music theory; there he became interested in organ building. He worked for Pipe Organs Incorporated for over ten years. Pete Sieker (b. Hamburg, 23 June 1929) apprenticed with Paul Rother (1947–50) in Hamburg and later worked for Rudolf von Beckerath in Hamburg and for Kemper in Lübeck. He emigrated to the United States in 1957, working as a pipemaker for

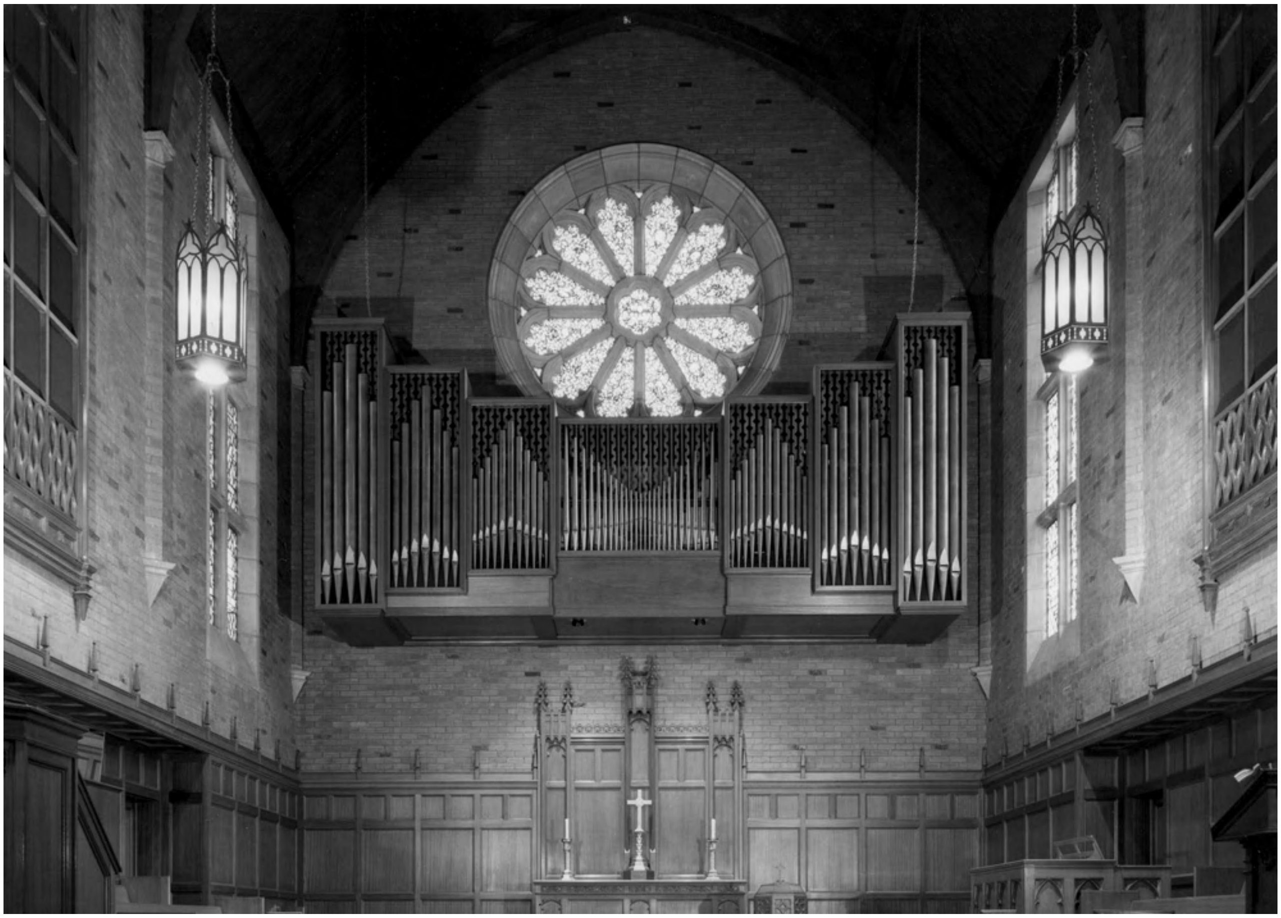


Fig. 1. Abbott & Sieker organ, op. 34 (3/45), Trinity Methodist Church, Pomona, California.

AUSTIN ORGANS, INC. (Hartford, CT) until 1958, when he moved to Los Angeles and began working for Pipe Organs, Inc. (an offshoot of the KILGEN firm), where he met Abbott.

During the 1960s Abbott and Sieker employed about ten craftsmen; an economic slump in the 1970s slowed the number of contracts, however, and the company was forced to build on a smaller scale. During its existence, the firm built 115 pipe organs in Los Angeles and southern California. Although the firm never built tracker organs exclusively, it played an important role in the ORGAN REFORM MOVEMENT of the western United States. The tonal ideal was sympathetic to the aesthetic of the "American classic" organ, and the company strived to build instruments possessing a fine ensemble sound and having organ cases harmonious to their architectural environment. Employees who eventually started their own organ-building businesses include MANUEL J. ROSALES, GREG HARROLD, RICHARD L. BOND, MICHAEL L. BIGELOW, Renée Marceau, and Winfried Banzhaf (who returned to Germany).

PETE SIEKER

DOUGLAS E. BUSH

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Pape, Uwe. *The Tracker Organ Revival in America*. Berlin: Pape Verlag, 1977.

ACCOUPLEMENT

SEE COUPLER

ACOUSTIC BASS

SEE RESULTANT/ACOUSTIC BASS/GRAVISSIMA

ACOUSTICS

Every musical action can be considered as the production of a chain of energy. The way this energy travels through the several parts of a system determines the final result: the sound we hear. A very important phase in the process of making music on the organ is the instrument itself. Being an energy system of its own, the important moments of its acoustic chain of energy are: (1) the floating air in or through the pipe and the disturbances of the equilibrium of the air within; (2)

the oscillation of the air column within the pipe, and (3) the radiation of sound from the pipe to the surrounding air.

All of these moments are governed by general mathematical and physical rules, but their actual behavior is determined chiefly by the nature and use of the building materials. A full understanding of the acoustic functioning of the organ is therefore only complete when the two levels (theory and actual realization) are both considered.

Introduction

The greater part of acoustic events has to do with periodic motions. A periodic motion consists of the repetition of a basic movement in equal intervals of time, such as the swinging of the pendulum of a clock. The time that is needed for such a single motion is called the periodic T, and is expressed in seconds. For the clock pendulum, this is the time to go from its perpendicular position (equilibrium) to the right, back to the equilibrium, to the left, and back to the perpendicular position. The number of times such a single motion (or cycle) takes place in one second is called the frequency

$$(f = 1/T)$$

and is expressed in hertz (Hz; 1Hz = one cycle per second).

We are also interested in the distance of the mass *m* from its equilibrium position. At every time *t*, this distance is called the displacement, or elongation *y* of the swinging mass. The maximum displacement is called the amplitude *a*, because the periodic motion takes place in two directions between - *a* and + *a*:

$$- a < y < + a$$

It is useful to represent periodic motion by a graph of displacement *y* versus time *t*. Some periodic motions have special characteristic. Of great importance in music is simple harmonic motion, which is characterized by the fact that the force that drives the mass to return to its equilibrium position is proportional to the displacement of this mass from its equilibrium. Simple harmonics can be represented by the projection of a point *p* traveling at constant speed around a circle; the projection is a sine wave.

When a pipe is blown, it produces a simple harmonic motion and longitudinal (compression) wave up and down its length. In longitudinal waves, the particles move in the same or opposite direction of that of the wave. A fine example of a longitudinal wave is given by the movement of a disturbed spring.

The pulses that are generated at the starting point are for the greater part reflected at the terminal point, and so they travel back in opposite direction. This reflection, as far as pipes are concerned, is a result from either the closure of the pipe or the sudden impedance mismatch when, at the edge, the air is no longer held back from spreading by the sides of the pipe. In general, impedance is the ratio between a force exerted on a system and the response of the system to that force. This has some important implications: if transfer of energy from one system (the air column) to another system (the pipe) is meant to be optimal, the impedances of both systems ought to match each other.

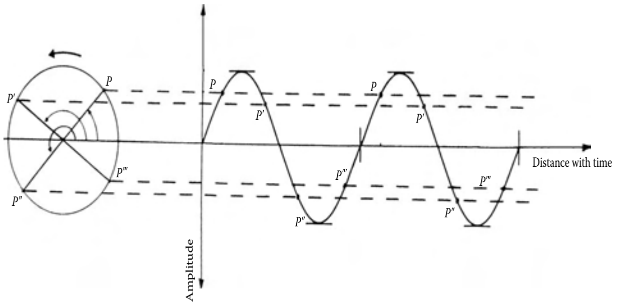

Fig. 2. The generation of a sine wave: the traveling of a point (p) around the circle, projected on a system of coordinates.

If pressure pulses are continually added to the oscillating air column, the wave becomes a complex system of initial and returning pulses at the same time. This might create a very chaotic situation, were it not that waves traveling in the same medium but in opposite directions can pass through each other. The principle of linear superposition determines the behavior of this passing: the pressure of the pulses with the same sense is added, and that of pulses with opposite sense is subtracted. This adding or subtracting is called constructive and destructive interference, respectively.

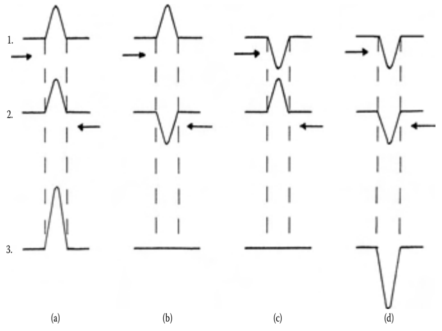

Fig. 3. The principle of construction and destructive interference: Waves traveling in opposite directions with opposite senses (1b + 2b and 1c + 2c) interfere destructively when passing through each other (3b and 3c). Waves traveling in opposite directions with equal senses (1a + 2a and 1d + 2d) interfere constructively when passing through each other (3a and 3d).

Mode versus Node

The continuous pulsation of a string gives birth to yet another phenomenon. The interference of initial and reflected pulses will create the impression that the wave no longer moves. The result is a standing transverse wave, having “nodes” at points of destructive interference with resulting zero pressure, and “antinodes” at points of constructive interference with maximal pressure. The presence of “nodes” and “antinodes” allows the air column to oscillate in several ways, or modes. For instance, if we consider a node that is in the middle, it divides the air column in two halves, and the column will also oscillate as two halves together with its basic vibration. Typically, every node produces its own frequency; as an aggregate, these are called partials (overtones).

The series of partials is a harmonic series. When we consider the fundamental frequency to be a result of the first mode, then the subsequent oscillation modes will result in the frequencies of the octave, the twelfth, the fifteenth, the major seventeenth, and so on, above the fundamental frequency. The present and relative strength of partials is very important for the final tone quality.

The resulting frequency f depends on the speed v of the air, the length l of the air column, and on whether one or both ends of the pipe are closed. The frequency $f\mathbf{n}$ of the nth oscillation mode is given by the following:

[1] $f\mathbf{n} = \mathrm{n}\ (v \div 2l)$ (for open pipes), and

[2] $f\mathbf{n} = (2\mathrm{n}-1)\ (v \div 4l)$ (for closed pipes).

Relations [1] and [2] indicate that

[3] Open pipes have their fundamental frequency one octave above the fundamental frequency of a closed pipe of equal length, and the higher resonance modes are different for open or closed pipes.

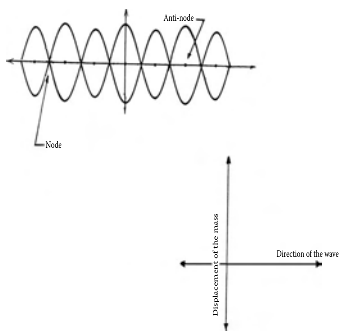

Fig. 4. Standing transverse wave, with nodes at points of destructive interference with zero displacement and antinodes at points of constructive interference with maximum displacement.

The relations [2] and [3] are in effect only when the diameter of the pipe is quite small compared to its length. Moreover, for very low notes, quite long pipes would be needed. To avoid this, pipes for lower notes are usually closed (stopped).

Stopped cylindrical (and square) pipes sound one octave lower, but lose their even partials and therefore have a different sound. Conical stopped and half-stopped cylindrical pipes descend a bit less than the one octave. Practical considerations therefore make builders use pipes with irregular dimensions and corrective techniques. The most common technique is end correction, a partial closure at the end of a pipe that produces its “effective” speaking length; this can be applied at both ends of open pipes or at the bottom end of closed pipes. Top correction for open pipes is done in order to have the antinode placed effectively at the end, but not beyond.

Organ Pipes: Acoustic Properties and Sound Production

In an acoustic sense, there are two main criteria to divide organ pipe classes. The first criterion has to do with the shape of the pipe. Four classes can be distinguished: (1) cylindrical (circular or square cross section); (2) exponential; (3) logarithmic; and (4) conical. Only cylindrical or conical pipes have resonance frequencies that are multiples of the fundamental frequency (in other word, their partials are harmonics). Most organ pipes are cylindrical or conical. Of much more importance is the classification of organ pipes according to their source of oscillation. Four classes of pipes can be distinguished: FLUE (LABIAL) pipes, REED (LINGUAL) pipes, pipes with FREE REEDS, and DIAPHONE pipes (with valvular reeds). The oldest and most common are flue pipes and reed pipes.

Flue or Labial Pipes

Flue pipes can be built of wood or metal. Wooden flue pipes are usually square, whereas metal flue pipes tend to be circular. The source of the sound is the flue (or slit), and it produces an edgetone.

When air flows around an object (or through a pipe), or when an object moves at some speed through a gas or fluid medium, some resistance is built up: fluid friction. Dependent on the speed, this fluid friction can have different realizations. The fluid pattern at low speed is regular and is described as laminar or streamline flow. Turbulent flow is the next step; characteristic of this pattern are small eddy currents behind the object. When the relative speed increases still further, the eddy currents become more prominent, and vortices (whirlpools) are created. They occur alternately on both sides. The trail of vortices thus arising is known as the Karman trail.

In flue pipes, air is blown with considerable strength against the flue. The flue therefore functions as a kind of wedge with the splitting of the Karman trail as a result. Strong modifications in the vortices also arise. This splitting of the Karman trail entails periodic air pulses, the Karman trail being swept from one side to the edge of the other. From this moment on, the air column in the pipe starts to "feed back"; indeed, the sharp disturbance of the air around the mouth of the pipe and the air within the pipe becomes a coupled system. The regular "puffs" of the Karman trail initiate the building up of resonant oscillation modes of equal or comparable frequency. Some modes come into existence very quickly and force the pulse frequency at the mouth to come "into tune." The frequencies at which the air column in the pipe responds are determined by the latter's length and the surface of its cross section. In theory, a steady state results. The resulting frequency is even determined in part by the mouth itself: the frequency field of the "puffs" depends on the ratio of the speed of the air to the distance between the lower and upper lips of the pipe. Moreover, the flue itself tends to stabilize at certain frequencies. In theory, a flue pipe will resonate steadily at the fundamental frequency. However, substantial increase in air speed or force may force the pipe to "jump" to one of its higher resonances, a phenomenon called OVERBLOWING (see below). It is thus conceivable that flue pipes will vibrate in all of their oscillation modes.

The distance between the two lips (i.e., the height of the mouth opening) is not only important for the determination of pitch; the mouth's dimensions also affect tone quality. The narrower the flue (the actual opening, or windway, through which air travels into the mouth), the softer the resulting sound. On the other hand, the ratio between the length and width of the pipe is important: the narrower the pipe, the richer the harmonic spectrum will be (due to the presence and strength of partials), and the more stringlike the sound will be. Though Backus and Hundley have stated that the pipe material itself is not very important for the sound quality, experiences of organbuilders and tuners tend to challenge this view.

Reed or Lingual Pipes

The main common feature between flue and reed pipes is their functioning as a coupled system. In both classes, the initial vibration is caused at the mouth (the slit for flue pies, the reed tongue for reed pipes); the air column in the pipe starts to oscillate and gives feedback to the source of vibration (although the degree of feedback is less for reed pipes). Both classes produce edge tones as the air is set in motion.

In the reed pipe, the frequency is determined not only by the length of the air column but by the length, mass, and stiffness of the reed. Normally, the longer the tongue is, the lower the frequency. Complementarily, the ratio between tongue length and length of the air column is also important. However, the mass and especially the stiffness of the reed tongue determine to a great degree the tone quality, for the thinner the reed is, the richer the tone will be. This raises the issues of the different series of partials that prevail for vibrating strings and air columns on one hand, and for vibrating "rods" on the other hand. If a reed is very stiff, it may behave like a rod, and thus have the partial series: 1:3:5:7:9 . . . instead of 1:2:3:4. . . . The rod's partials are fundamentally inharmonic; a reed constructed in this way will have poor tone.

An important feature in reed pipes is the presence of several modes of vibration in the reed itself. It is thus possible to have quite different sound qualities within the class of reed pipes. Indeed, when reed pipes are of full length, the pipe usually resonates to the fundamental frequency of the reed together with whatever partials present in the reed; a very rich tone results. If, on the contrary, the length of the pipe is diminished, it will only resonate to the higher partials of the reed; buzzing sounds of somewhat indefinite tone occur.

Compared to flue pipes, a full-length cylindrical reed pipe has more or less the same dimensions as a stopped flue pipe of the same pitch. Full-length conical reed pipes are a bit shorter than open flue pipes of the same pitch. For conical reeds, the length is more or less three-quarters of the pitch length for cylindrical pipes (e.g., 6' or 7' length for an 8' Trumpet). Lingual pipes are also known as "beating" or "striking" reeds, to distinguish them from the next category.

Pipes with Free Reeds

Like its model the reed or lingual pipe, the free reed receives its oscillation from a vibrating reed. The length, mass, and stiffness of the reed are equally important in determining pitch and tone. The major difference is that, while the reed inside a lingual pipe beats against a shallot when it vibrates, a free reed comprises a close-fitting tongue that oscillates through a hole in an oblong plate of brass; it swings without striking, thus is "free." The major advantage of free reeds is their tolerance of crescendos and diminuendos without pitch change; this "expressive" feature of free reeds accounts for their great success in the nineteenth century. The primary drawback is that the tone of a free reed is poor in quality by virtue of its vibrational freedom. The absence of a controlling shallot causes irregularity in the reed's vibration, and not all important partials are firmly established.

Diaphones (Valvular Reeds)

Acoustically speaking, the diaphone (patented by Robert HOPE-JONES, 1894) are unique. The source of oscillation is not a stream of steady air, but a regular succession of air puffs. When the keyboard is activated, air under pressure sets a vibrator in motion. A small disc is connected to the free end of the vibrator; as the vibrator moves, the disc admits regular puffs of air into a pipe. The length of the connecting piece between vibrator and disc determines the frequency of the air puffs and thus of the pitch. Valvular reed pipes have the same "expressive" qualities of free-reed pipes, with even louder dynamic possibilities. However, the diaphone was so distinctive that it could not blend with other classes of pipes or timbres; it was limited to theater organ use, more notable for "effect" than for inherent musical qualities.

Overblowing

When a great amount of force is exerted on an oscillating air column in a pipe, the pipe may at some point "overblow." Overblowing is simply the shifting of a fundamental oscillation mode to a higher mode; the overblown tone will therefore be one of the higher partials of the fundamental frequency. Some organ pipes are built precisely to create this overblowing result, with narrow scale and mouth. Open pipes normally overblow at the second partial (an octave above the fundamental) and have a length twice the pitch length. Stopped overblown pipes sound the third partial (a twelfth higher) and are three times as long. One typical overblown flute pipe, the Flûte Harmonique, is of double length and normal scale, and is pierced at the point where the node occurs (around the middle of the pipe) with one or two small holes. When overblowing is undesirable, especially in narrow-scaled string-toned pipes, builders add ears, beards, and other small metal devices around the mouth of the pipe to help direct the air.

PETER G. C. VAN POUCKE

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ACTION

The technology by which the performer is able, by pressing a KEY, to activate a motion from the KEYBOARD through the WINDCHEST to a now-open PIPE, at which point the pipe sounds. This article is divided into the following sections:

Mechanical Actions
Pin Key Action
Suspended Key Action
Balanced Key Action
Floating Action
Pneumatic Actions
Tubular Action
Electro-pneumatic and Electric Actions
Austin Universal Windchest Action
All-Electric Action

Mechanical Actions

A means of connecting the movement of the manual keys with the sound-producing elements of organ (windchest, pallet box, pipe) so that the organ could be played. As larger organs were built in the fifteenth century on, it was not longer possible to align each key with its corresponding pipes using a direct pin key action. The use of flexible strips (tracks), rigid rods (stickers), fulcrum-based parts (backfalls, squares), and the rollerboard allowed the "transmission" of the action from the depressed key to the opened pallet (all parts were made with wood, and no superior material has been discovered). SLIDERS that allowed a stop to open or close could be controlled from the console via a drawstop attached to a trundle and sticker device. Two mechanical (also called tracker) key actions developed in the Renaissance were the (earlier) suspended and (later) balanced systems; the so-called floating action was developed to compensate for atmospheric changes in both.

Pin Key Action

This is the earliest form of mechanical action, in which a sticker, a rigid thin wooden (or metal) rod, transmits action from keyboard to windchest pallet. In the earliest approach (Renaissance and beyond), a pallet box was located below the keyboard; its pallet was held in place by a spring. Depressing a key caused a sticker attached to the bottom of the key's front end to push down and open the appropriate chest pallet, allowing air to enter the upper chest (groove, or KEY CHANNEL) from the lower, air-collecting chest and from there to the RANK of pipes. Each key and pallet was directly connected with the associated pipe or pipes. This system was also found in portatives, positives, regals, and smaller house organs. As slider-chests came into being, room needed to be made for the sliders; the pin action was shifted so that the keys were below the pallet. The sticker was attached to the top of the key, which now functioned more like a lever; with the use of a backfall, the pallet was pulled instead of pushed down. In pedalboard actions, the sticker was attached under the back end of the key so that, when engaged, it moved a more extensive device to engage the pedal chest pallet. This somewhat less direct system was the basis for mechanical (tracker) key action, which made the building of larger organs (with wider keys) feasible, thanks to the development of the rollerboard and the use of trackers and squares (in addition to backfalls and stickers).

Suspended Key Action

In suspended action, the key is supported by a fulcrum at the tail end; the tracker that pulls down the roller connects at approximately the midlength of the key. As with balanced action, the tracker pulls down the roller through a button, and the windchest end of the roller pulls down a tracker, which opens the chest pallet. Suspended action is based on pulling its components (i.e., there is no "transfer" or redirection of motion through change of direction) and is generally considered to have a lighter and more sensitive touch. But, unlike balanced action, the suspended key is a more secondary lever, held up by the pallet until depressed.

Suspended action retained its usefulness through the centuries, giving way to the pneumatic actions of the nineteenth century. With the later twentieth century's renewed interest in historic organs, the suspended action returned to favor among organists and organbuilders who sought to restore or re-create as many elements of the pre-pneumatic instrument as possible. However, balanced action was extensively used by U.S. and European builders in the nineteenth century, even as pneumatic WINDING of organs became the norm. A majority of builders of new tracker organs retain a neoclassical aesthetic, and suspended action remains their preference. But the growing neoromantic revival points to continuing efforts on behalf of balanced action, and other builders simply prefer it to suspended action.

Balanced Key Action

In balanced action, a key is propped by a fulcrum somewhere at its midlength: pressing the front end down lifts up the tail end of the key. This lifts the front of a backfall, also resting on a fulcrum; the backfall's tail end descends, pulling down a tracker attached to the key's specific roller through a small projection (button). At the other (windchest) end of the roller, another tracker pulls down the pallet inside the chest, allowing air to flow through the foot of the pipe and sounding it. Because the tracker connects at the tail end of the key, the pallet holds the key up in a less direct way. The key becomes a more primary lever in balanced action, arguing in favor of a special sensitivity because of its more direct relationship between finger (key) and sound (pallet). The figure on the following page shows the parts involved in balanced key action.

This next figure shows in simple cross-section the difference between balanced and suspended key actions.

When the tracker began its twentieth-century revival, suspended and balanced actions were also revived. At first, balanced action was felt to be sluggish and heavy when compared to suspended action, and was mostly abandoned. Improved engineering has led to progress in building successful balanced actions; these allow the organbuilder to be more flexible in instrument design while retaining a sensitive key touch.

A significant advantage of balanced over suspended action is its use in detached consoles. The Baroque North German and Dutch organs focused on during the European ORGAN REFORM MOVEMENT were moderate in size, with limited development of 16' or 8' manual stops, smaller pipe scales, and shorter keyboard compasses. The organ was arranged in compact WERKPRINZIP cases, division atop division; straightforward suspended action was easily applicable. Present-day American Werkprinzip organs have more 16' and 8' manual stops, full compasses, and larger pipe scales. Such instruments often require larger cases that generally will not fit under the ceilings of nonvaulted American buildings. Unlike suspended action, balanced key action allows the console to be detached from the case, which promotes a close association between the organist, instrumentalists, and choirs.

In all mechanical actions, friction must be eliminated throughout the system wherever possible. Several elements contribute toward the best possible conditions: (1) appropriate leverage, the ratio between the depression of the key and the opening of the pallet; (2) a precise and noiseless "pluck point" (CHIFF) when the key is depressed, the air seal on the pallet is broken, and the pallet moves away from its seat of rest, allowing air to flow; (3) an overall quiet action with a minimum of "bushing" (felt and other materials) used

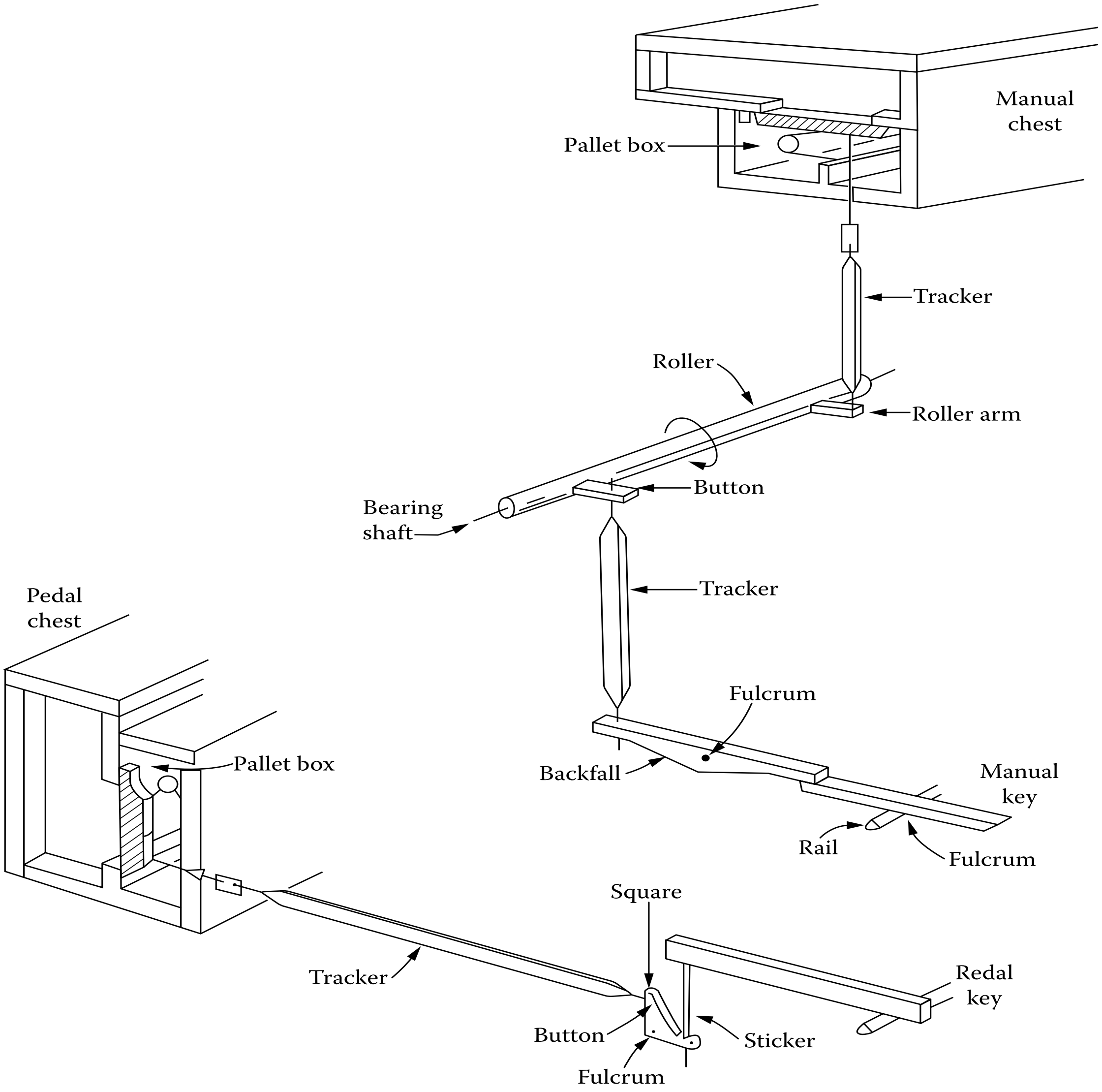


Fig. 5. Components of balanced key action.

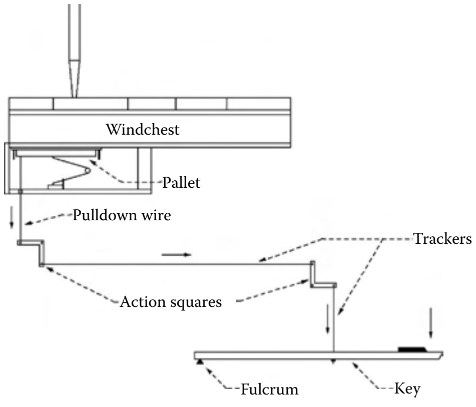
to "smooth out" the action but highly vulnerable to climactic changes; (4) a well-balanced pallet able to deliver to the key channel; and (5) keeping horizontally suspended trackers well-supported (with tracker pendulums) without sagging (with tracker hangers) or slapping against each other (with comb guides).

Well-made trackers, squares, and rollers can help reduce inertia in the key action. To ease the playing of rapid music, the travel of the action can be reduced at the first action square after the keyboard; the whole action then moves a smaller distance. Then, at the last square or roller before the pallet, the motion is increased to equal the key movement again.

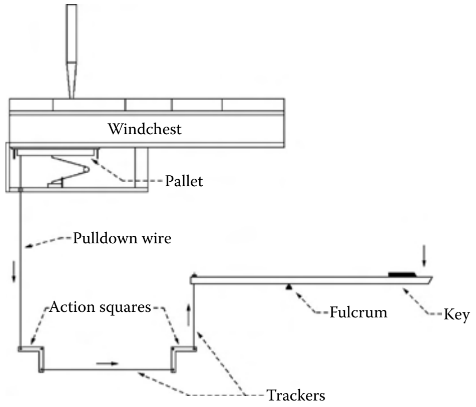
Floating Action

The reduction of friction in tracker action organs is accomplished most significantly by floating action, named for its ability to move up and down to compensate automatically for climactic changes that alter the relationship between keyboard and pallet. Also called self-regulating or self-adjusting actions, floating actions subtly overcome inertia to permit undisputed key-to-pallet movement while preventing excessive motion.

Each floating action is a wooden or metal beam with one action square per note on the manual keyboard attached to it. This beam is usually placed below the windchest at the point where the horizontal trackers coming from the console turn to go up to the chest. The actions of the squares are eventually communicated (backward) to an additional square rail. This is floated with a mineral oil–filled dashpot, which holds a piston within. The cylinder is attached to the square beam, while the piston is anchored to a



Suspended key action



Balanced key action

Fig. 6. Suspended and balanced key actions.

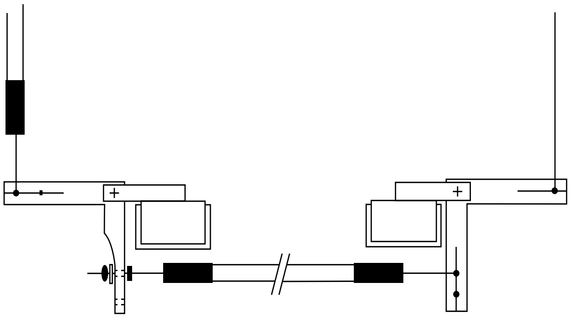


Fig. 7. Controlling keyboard inertia: Squares interact with movement of tracker.

point above, providing a damper effect to allow for gradual adjustment under a small amount of constant pressure while preventing sudden responses to musical extremes. The action then continues to the rollerboard and beyond. Floating action requires less maintenance and preserves the overall quality of the tracker action longer than more direct solutions. It represents a solution to a particularly modern "problem": the effects of the American heated church, causing fluctuations in temperature and humidity that never occurred in the unheated churches of Europe.

Pneumatic Actions

The most ingenious development in nineteenth-century organ building was really an application of one of the organ's oldest principles: the pneumatic (wind-driven) motor. As hand-blowers were sending compressed air into the windchest, reservoir, or feeder, builders realized that some of the air being taken in could be diverted. In effect, the pneumatic is a small bellows, made in different forms, to actuate various components within an organ. This would allow organs to increase in size dramatically by the end of the nineteenth century, especially as detached consoles were employed.

The ultimate goal of pneumatic devices was to lessen the weight necessary to depress a key and thus engage the sound-processing mechanism. The earliest such device was the relief pallet, a small pallet that opened first to break the air seal on the larger pallet, thus relieving the heavy pluck in large pallets and reducing the pressure required to open those pallets. This figure shows several types illustrated in George A. Audsley's *The Art of Organ-Building*:

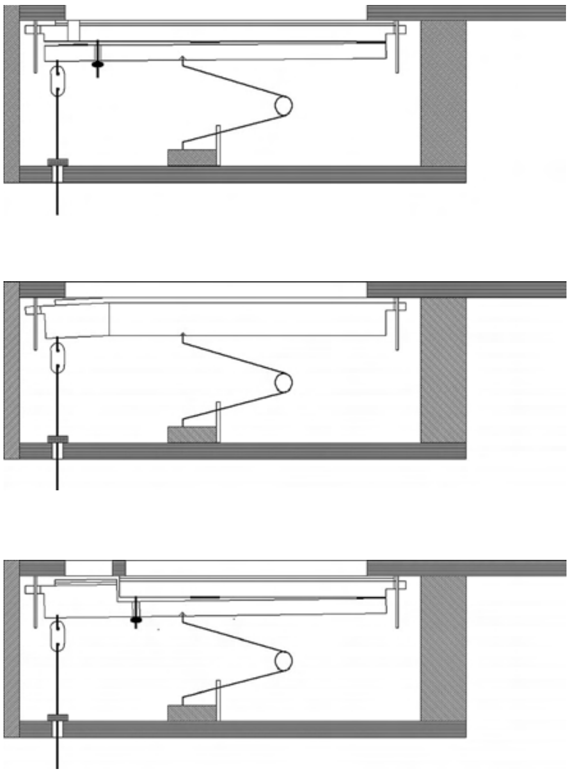


Fig. 8. Three early twentieth-century types of relief pallets.

Such devices reduced the pluck, but added a "spongy" feeling to the action.

After further experimentation, BARKER LEVER action replaced the relief pallet. It allows the use of unimpeded finger action regardless of the number of pallets to be opened. The Barker lever was the first widely accepted organ "pneumatic motor." Pressurized air from the main bellows moves into the lower half of a divided windchest, dedicated to a single key, with an escape valve. When that key for that chest is activated via a backfall, a "pallet valve" is pulled down, forcing the pressurized air through to the upper half (escape valve now sealed) and from there to a duct that leads to a second, single-fold wedge bellows (the pneumatic motor). The bellows fills, pulling down a tracker (or other device or devices) that in turn pulls down the pipechest pallet. When the key is released, the pallet valve springs back to close off air to the upper half, and the exhaust valve is reopened to let air escape. No more air is forced through the duct, and the pipechest pallet tracker releases its hold on the pallet itself, silencing the associated pipes.

This remarkable "mechanical-pneumatic" device, introduced in France in the 1830s by Charles S. BARKER, became a signature element of Aristide CAVAILLÉ-COLL's organs (beginning with Paris, St. Denis, 1837); he and others saw that this pneumatic motor improved the action of larger instruments, and he employed the device until the end of his career (he did not turn to tubular pneumatics until the 1890s). As adapted by Cavaillé-Coll, these levers not only allowed higher wind but also permitted the organist to play when all manuals were coupled together, producing a new and powerful sound. The organist had only to provide force sufficient to open the relatively small pallet incorporated into the Barker lever; this "machine" then did the heavy work of opening the large pallets that allowed the pipes to speak.

The application of the Barker lever caused the lessening of direct control of the pallet and a resulting loss in touch; but its application of coupling to manuals and (later) combination actions, and its contribution to evenness of wind, were fully exploited by builders and performers alike.

Tubular Action

The application of the pneumatic principle led to the development of an action that allowed for larger organs and the detached consoles that became increasingly necessary. As instruments grew, so did the length of the windtrunk from the main bellows to the pipechests as well as the distance between console and windchest. The TUBULAR ACTION that developed in the 1840s and '50s in France took advantage of the available wind pressure at both the console and windchests stages; the two types depended on lead tubing, two pneumatic motors, and a pipechest pallet to transmit stop and key actions.

One system, called pressure-pneumatic or inflate-pneumatic, had a separate, small "touch box" above the tail end of the key, which was under pressure. Depressing the key caused a small pallet to open, an exhaust pallet to close, and air to travel through lead tubing to the main windchest. At that point, a vertical "primary" motor opened an escape valve, depriving a horizontal "secondary" motor of air pressure. The wedge bellows deflated, pulling open the chest pallet and forcing air into the pipes. In the other system, the exhaust-pneumatic, the key action simply opened a key pallet that caused a domino effect: the air in the tube escaped, deflating the primary motor (under air pressure), which opened an escape valve that deflated the secondary motor, pulling open the chest pallet to supply air to the pipes. In other words, the exhaust-pneumatic principle utilized a vacuum to cause the organ to sound, a counterintuitive but successful approach.

Tubular pneumatics solved many of the problems that large Romantic organs brought with them, but the response was mixed, with the most favorable coming from England, the U. S., and (later) Germany; E. F. WALCKER and other builders continued to work with mechanical actions late into the century. Most French builders were content with perfecting Barker lever–based systems. Of the two systems, exhaust-pneumatic was preferred, considered less sluggish and more quiet and durable than the pressure-pneumatic.

German builders at the time were increasingly fond of the cone-chest (*Kegellade*, a kind of VENTIL chest), an alternative to the slider-chest still in use. In the cone-chest organ, all pipes of a rank were MOUNTED on a single channel, without grooves or other "bars"; opening a stop meant that all keys in the ranks were being supplied with pressurized air. The key action used a series of trackers, backfalls, and squares to raise a "lift rail"; this caused the cone-valves to rise as a group, so that any open rank would force air into a conduit leading directly to the pipe and causing it to speak. The cone-chest's valves need not have been cone-shaped; in some cases, they were replaced by discs operated by small pneumatic motors (bellows-chest).

The membrane-chest, another ventil type, was explored by German and American builders in the late nineteenth century. William SCHUELKE, a Prussian-born builder working in Milwaukee, patented a membrane-based tubular pneumatic windchest (1895). Here the pressurized air filled both the STOP CHANNEL (when open) and a key channel below the ventil channel. When closed, the key channel's air pushed up a leather membrane that closed off a conduit to a specific pipe, keeping air from reaching it. Depressing the key released the key channel pressure, which allowed the ventil channel air into the conduit, where it forced the membrane open as it entered the pipe. Again, if the stop rank was open, the pipe for that note would speak.

While tubular systems were superseded by electro-pneumatic actions from the late nineteenth century, they were still being used with some frequency up until World War II. In the present age of restoration, attempts to install electric systems where there had been none have often proven difficult; consequently, tubular pneumatics have seen a revival in the spirit of neoromantic authenticity (and modern practicality).

While the pneumatic Barker lever became the basis for several systems, other pneumatic "machines" worked to assist the overall winding and action. These devices included wind regulators such as the concussion bellows (winker) and schwimmer. Two major builders contributed the Willis floating and Fisk servopneumatic levers, latter-day successors to the Barker lever. A recent solution to problems caused by higher wind pressures, multiple divisions requiring coupling, and detached consoles, one that avoids the Barker lever altogether, is the pneumatic balancer.

The pneumatic balancer is mounted to the bottom board of the pallet box with a forked arrangement to connect it to the pallet pull-down wire (tracker). The principle of the balancer is that the pneumatic motor (A) has a connection to the key channel in the windchest via the tube (B). Because the pneumatic is pulled open when the pallet is closed, the pressurized air in the pallet box (C) is always trying to collapse the pneumatic. The pneumatic is pulling against the pull-down wire (D) at the forked connection (E). The air pressure against the sides of the pneumatic exerts enough pressure to balance with the air pressure against the pallet (F). When the player presses a key on the keyboard, the organist's finger is in direct control of opening the pallet, yet the pressure exerted by the pneumatic greatly reduces the pressure required to open the pallet.

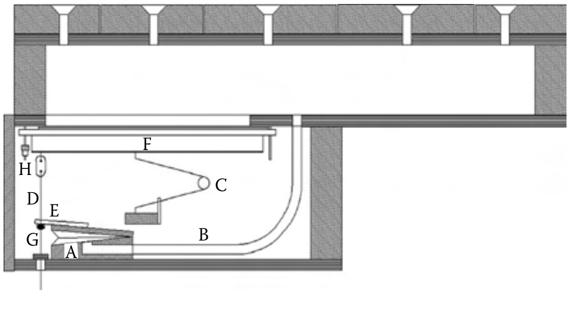


Fig. 9. Regulating resistance: pneumatic balancer mounted to the bottom board of pallet box with control of pneumatic extension through nut on pull-down wire.

Electro-pneumatic and Electric Actions

The harnessing of electricity was seized upon by organbuilders, first in France, and later in North America and the rest of Europe. Although experiments with electricity began in the mid-nineteenth century, only in the 1880s did reliable systems involving electricity become feasible, notably in the work of Hilborne L. Roosevelt. He patented an "electro-pneumatic" key action as early as 1868; exhibited a part tubular-pneumatic, part electro-pneumatic instrument at the Philadelphia Centennial Exposition (1876; 3/46); and, with his brother Frank Roosevelt, built an instrument (Great Barrington, MA, Congregational, 1883), in which its complex "blowing apparatus" was placed in a cellar room below the vestibule: three water motors (for winding and combination action pneumatics), horizontal feeders, large windtrunks and airshafts, bellows large and small, pneumatic actions, and regulators, all leading to the organ's various departments.

The electro-pneumatic system was indeed a fusion of the old (pneumatic action) and the new (electromagnets). The key action set off the contact plate of an electrified magnet; this effected the closing of an armature valve, initiating the familiar double-motor valve process. As before, each key had its own system. The Austin Universal Windchest (see following page), developed in the early twentieth century, continues to use electro-pneumatic action. At this point, the addition of electromagnets to the pneumatic equation served to replace the key touch box or pallet and the lead tubing. Early systems used a form of membrane-chest action. However, the invention of the pitman chest by Ernest M. Skinner offered a more sophisticated use of pneumatics by which a single windchest and its conduit determine the action not only of the electromagnet and armature valve but (following the process) a rod with two seals, the pitman (a small valve), and the pallet and a flexible membrane attached to it. Each pipe conduit has its own pitman unit. The entire action is determined by the presence or absence of pressurized air along the way (see Cook). The system remains in use today.

Electro-pneumatic actions became associated with the "American classic" version of the Organ Reform Movement, specifically in the work of G. Donald Harrison and Walter Holtkamp. It should not be too surprising that these most eclectic of builders, trying to make instruments that were all things to all historical eras of organ music, would rely on the most "up-to-date" action. Other builders took advantage of the new relay and switch systems to build electromagnetic versions of the binary principle ("on" or "off"; later, "a" or "b") to produce an electric system that skipped the pneumatic element of organ action simply opening a pipe's pallet directly. Complementarily, electric rotary turbine blowers became the standard mode of winding.

Robert Hope-Jones refined electro-pneumatic action, not only to permit the organ console to be placed at a distance from the pipes that it controlled, but to support the system of unification, which allowed a rank of pipes to sound at different pitches and on different keyboards. He and others applied electromagnetics to stop actions (e.g., sliders) and MECHANICAL AIDS (COUPLERS, combination actions) as well as the TREMULANT and SWELL chest shades.

However, the most dramatic use of relay and switch systems was in the development of the UNIT CHEST. Duplexing (in which more than one manual can control the same pipe rank) and extension (UNIFICATION, which allowed a rank of pipes to sound at different pitches and on different keyboards) saved the expense and extra space required by a full set of pipes. Duplexing and, to a lesser extent, extension were original mechanical in nature; but electro-pneumatic and electromagnetic technologies (e.g., Wicks's "Direct-Electric" system; see below) became the preferred method of engineering the unit chest's components.

Hope-Jones's dream of a truly "orchestral" instrument was realized in the UNIT ORGAN, in which the unit chest principle was extended to as many different ranks and pipes as possible (the so-called floating chest). This took the form of the fully electric theater organ, which took the qualities of the automatic barrel and band organs, tailored them to providing soundtracks for silent films, and put them back in the hands of live players, much as Georg Joseph VOGLER must have hoped would happen with the first ORCHESTRION more than a century earlier.

Austin Universal Windchest Action

A type of action invented by the English-born John T. AUSTIN, who came to America in 1892. He first joined the firm of FARRAND AND VOTEY in Detroit. Familiar with the limitations of organ action systems then in vogue, Austin developed and patented a new action that he called the Universal Air Chest System (1893). The first Austin patent action organs were built in the shops of Clough and Warren in Detroit, starting in 1893. The AUSTIN ORGAN COMPANY was established in Hartford, Connecticut, in 1899.

In any pipe organ, the numerous pipes of different lengths and pitches stand on a box (windchest) of lightly compressed air, under the top of which are valves that, when operated, control the flow of air up into the pipes. The type of control within the windchest and the types of connection between the playing keys and the valves designate the form of action in a given instrument.

A pneumatic motor is a small bellows, made in different forms, to actuate various components in an organ windchest. The current Austin action is designated as "electro-pneumatic," whereby the connection between the console and the organ is electric, but the actual opening and closing of the valves is achieved pneumatically—that is, utilizing the lightly pressured air already within the windchest to do the actual work of opening and closing the valves. The Austin action is unique in the industry because it is essentially a very open mechanical system of lightweight but extremely durable components, operated by only one set of pneumatics inside and along one side of the windchest.

In almost any pipe organ the pipes stand in rows on the windchest with the valves beneath in matching rows. To actuate the valves in an Austin organ, each key has a pneumatic connected to a lightweight wooden trace or "tracker," which in turn is connected to all valves of all pipes of a given note. Thus, there are sixty-one key pneumatics and associated trackers in a standard windchest, one for each note of the five-octave keyboard; in theory, pressing one key down can generate the sound of all pipes associated with that note. The "stop action," which allows a particular set of pipes to be played (or not) at the will of the organist, consists of a long metal rod or bar running along under each row of pipe valves. This bar rotates a third of a turn either "on" or "off," thus acting as a removable fulcrum to make each row of valves active or inactive when individual key pneumatics and associated trackers are activated from the console. Only those pipes of a particular timbre associated with a stop in the "on" position will sound; the stops may be combined as the organist prefers. As with most mechanical systems in a well-built organ or piano, the load on any one component is very light, so that as a group they are extremely durable and long-lasting.

Over the years, many developments and improvements have been made in the Austin action, but the basic concept remains the same. During his long career, Austin held no fewer than forty-eight patents related to the pipe organ, especially windchest and console developments. The term *Universal* derives from the fact that it is a very open system whereby each pipe, when speaking, is connected directly to the air supply of all of the other pipes with little or no channeling through masses of lumber or air conductors. The windchest may rest on a small room full of lightly pressured air (airbox) or be built with transparent bottom panels. With either approach, all of the action components are clearly visible to a person standing beneath. Typical air pressures in a pipe organ range between 1-1/2 to 2-1/2 ounces per square inch, although occasional special stops may require up to 12 ounces per square inch. Inasmuch as all of the valve action in an Austin windchest is immediately under the top surface of the windchest, an Austin organ can be built with windchest tops as low as 26” off of the floor, important when space is at a premium.

All-Electric Action

The idea of an all-electric action followed logically from the application of electricity to winding and key-stop actions. Perhaps the first integrated pipe organ electric action, one still being produced, is the Direct-Electric system, a trademark for an invention by the WICKS Organ Company of Highland, Illinois (1915–17). Developed as a successor to mechanical action and as an alternative to the tubular- and electro-pneumatic actions of the period, all-electric action uses electromagnets for all its functions. Keys and other console controls operate electrical contacts; cables and switches direct the current to electromagnetic valves under the pipes.

Early attempts to use electricity to eliminate mechanical action parts (by the 1870s) were hampered both by lack of reliable current sources and by “residual magnetism,” which caused the moving armatures of strong electromagnets to become magnetized and stick to the cores; weaker magnets avoided residual magnetism, but were less effective. Other attempts used pneumatics to open the pipe pallets (controlled by very small electric valves) or placed small electric valves within tubular systems. These methods allowed remote consoles, and were developed into widely used electro-pneumatic systems in the twentieth century.

Wick’s attempts to solve the problems with strong electromagnets were directed toward finding a method of opening the pipe valves directly with electricity. This research led to the development of the magnets used in the Direct-Electric system (trademarked 1926); the first organ incorporating this action was installed in Unison City, Indiana (May 1915). By about 1917, all Wicks organs had this action. Wicks had to repair or rebuild almost all of them up until around 1920, installing improved components. Other action parts and improvements were patented: valve action (1922), reversible (1926); switch mechanism (1926); relay (1930); combination action (1930); balanced valve (1934); transposing switch (1962); and solid-state relay (1964).

The electromagnets and the windchest action are the heart of the system. The center-pivoted manual keys have a bronze plate striking a series of contacts with a wiping motion (which cleaned off the wire) when the key is depressed; the contacts, originally phosphor bronze wires, were changed to silver to avoid corrosion and dead notes (early 1950s). The contact point could be felt when playing; the contacts were mounted at an angle (1966), providing more wiping motion with less key force. The pedal contacts were originally mounted at the end of the keys, but moved below the keys to reduce strain on the contact wires (1985).

A key contact wire, one per keyboard stop, handled the current for each chest magnet. The large console cable went directly to the chests, one wire per pipe. When couplers were added, or a keyboard had more than fourteen stops (but no couplers), relay and switch systems became necessary. Early relays had a wooden roller with a contact bar on one side, rotated by a relay magnet to make a wiping contact with a set of contact wires. These were replaced with “steel” relays, in which the relay magnet moved a plated contact against the contact wires (1938). These units had a felt bumper to control bouncing (and interference with the release of the key) on the “off” stroke. In the 1950s these contact wires were also changed from phosphor bronze to silver. In 1964 solid-state relays were introduced; the key circuits controlled large power transistors, which supplied current to the chest magnets without relay contacts; switches were used only for unified stops and for couplers. These relays were supplanted in 1979 by a completely transistorized system, requiring only a single key contact and without moving parts or contacts.

In all these systems, each stop and coupler was controlled by a multiple-contact switch, an original component of Direct-Electric action. These switches initiated couplers (in the console) and stops (in the relay cabinets or the console). Turning a stop or coupler “on” activated a magnet that moved an armature containing phosphor bronze (silver after 1967) contact pins; these made a wiping contact with bronze leaves arranged in a row while closing a circuit for each note. When used for stop switches in the transistorized relays (1967–79), the pins were replaced by diodes. The introduction of solid-state systems made these switches redundant.

The first electric combination action, located in the console, operated “lock bars” that latched contacts into “on” or “off” positions when setting pistons. To set the combinations, multiple-contact switches directed current to the appropriate magnets; the latched contacts constituted the “memory,” and relays distributed the current. In 1934, a new remote system was introduced, in use until the 1970s, that retained the multiple-contact switches for setting combinations but required only one magnet per stop and a mechanical trace to move the latched contacts. Like the main coupler and multiple-stop systems, current was distributed to the combination actions by rotating wood contact bars, replaced in 1938 with steel relays. Swell and crescendo pedal contacts operated in a similar manner.

In the console, stop and coupler controls incorporated a two-magnet system to manipulate the stops. In the 1930s these magnets were separated from the stop controls, so that there were now separate contacts for stops and for combination action settings. Reversibles used a similar two-magnet unit with a latching contact that switched the current between opposite magnets. These units were gradually replaced (from 1979). Later developments incorporated parts from outside suppliers: new piston contacts (1960s); the introduction of transistors (1960s); an experimental transistorized memory system (1975); cable connectors designed to permit finished cables to be pulled through conduits (1979); and a solid-state system, located inside the console (1979).

Because Direct-Electric action was introduced as an "improvement" over other actions (primarily electro-pneumatic), most of the commentary about it was found in sales literature, with Wicks as proponent and competitors as opponents. Advocates emphasized reliability, longevity, reasonable cost, and the elimination of releathering. Criticisms included "hazards" from large electric currents, "spongy" keyboards, noisy consoles, and excessive unification. In spite of early criticisms, the use of all-electric action has become widespread since the 1920s, with suppliers to the organ-building trade offering many such parts.

Barnes is the best source for illustrations of the earlier Direct-Electric system. In evaluating his claims, readers should remember that he was not an organ-builder (see the introduction to the second edition).
See also **Mechanical Aids; Pouch or Puffer Note Control**

Lynn A. Dobson
Fredrick L. Mitchell
John E. Sperling
Richard Kassel

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ACUTA

See Scharf/Scharff/Sharp/Scherp/Acuta

ADEMA

Dutch organ-building family. In 1855, brothers Carolus (Karel) Borromeus Adema (1824–1905) and Petrus (Piet) Josephus Adema (1828–1919) opened De Gebroeders Adema in Leeuwarden (Friesland). Karel had apprenticed with the van Dam firm and worked for Bätz and Witte (Utrecht), while Piet worked first for Willem Hardorff (Leeuwarden), then for Hippolyte Loret (Mechelen); Hardorff was especially influential on the Ademas. A younger brother, Johannes Romanus Adema (1834–1862), worked for the firm as a case builder, while Adrianus Adema (1825–1870) and Epko Adema worked there in other capacities.

The first Adema instruments were built for Leimuiden (1856) and Leeuwarden, St. Nicolaaga (1858), the latter the firm's first two-manual organ (now Terneuzen, Good Shepherd). Another early instrument stands at Heerrenveen, Holy Spirit (1867; rest. Reil, 1986).

In 1871 Adema reached a turning point with its three-manual organ for Amsterdam, Mozes en Ääronkerk/St. Anthony of Padua (now much altered), in which the firm's classical Dutch approach was modified by French elements such as the Barker lever. This hybrid style was incorporated into the firm's instruments at Veenhuizen (1872), Oudkarspel, Hervormde St.-Maartenskerk (1874; destr. 1969), and Bodegraven (1876).

In 1877, the firm split into two companies, with Karel (C. B. Adema & Zonen) remaining in Leeuwarden and Piet (P. J. Adema & Zonen) relocating to Amsterdam. The reason for the split may well have been philosophical, with Karel favoring the older Dutch style while Piet welcomed the new, more international elements represented by Aristide Cavaillé-Coll. In Leeuwarden, C. B. Adema and his sons, Lambertus Theodorus Adema (1864–1931) and Sybrandus Johannes Adema (1863–1941), maintained the Dutch classical style, using mechanical action and focusing on the Frisian market, as in Leeuwarden, St. Bonifacius (1899), Balk, St. Ludger (1910; rest. A. Schreurs, 1985); Warga, St. Martin (1911; rest. 1994–99); and Irnsum, St.-

Marcuskerk (1926; C. B. Adema's first pneumatic organ). The firm closed after Sybrandus's death.

Using the Mozes en Aäronkerk organ as a starting point, P. J. Adema & Zonen's instruments increasingly reflected the Cavaillé-Coll aesthetic, as in Workum, St. Werenfridus (1884–85; rest. Adema, 2003), Harlingen, St.-Michael (1898; rest. A. Schreurs, 1999–2000), and Pijnacker, St. John the Baptist (1898–99). P. J. Adema introduced pneumatic action into its instruments, beginning with Uitgeest, Birth of Our Beloved Lady (1898; rest. H. Schreurs, 1977); later examples include Gouda, Our Beloved Lady (1902; now in Bussum, St. Vitus) and Haarlem, St. Bavo's Cathedral, transept organ (1906–7, pneum.; rest. Vermeulen, 1960–61, electro-pneum.). Piet's sons Sybrand Adema (1868–1926) and Joseph Adema (1877–1943) continued the firm, but worked separately. Sybrand built instruments for Amsterdam, St. Anne (1916) and Amsterdam, Beloved St. Nicholas and St. Barbara (1923; now Groenlo, St. Calixtus). Joseph Adema's most important work was the three-manual organ for Amsterdam, St. Willibrordus (1920–24, pneum.; now Haarlem, St. Bavo's, 1971, electro-pneum.). Following the death of Joseph Adema, P. J. Adema was taken over by his nephew Hubert Schreurs (1906–1981), who continued the French-influenced tonal traditions while reintroducing slider-chests and mechanical action wherever appropriate. Schreurs focused on the restoration of instruments by his predecessors and others (Vermeulen). An exception was the new organ at Oudkarspel, Lutheran (1972, mech./elec.). After his death, his son Antoine Scheurs (b. 1942) took over. With church closings becoming more common, Scheurs's work was oriented almost exclusively toward maintenance and restoration. Even the "new" organ at Bodegraven, St.-Willibrordus (1984, mech.) took much of its pipework from an 1898–99 MAARSCHALKERWEERD organ previously in Alkmaar. In 2002, Antoine Schreurs turned the firm to his colleague Ronald van Baekel (b. 1969). Renaming the firm Adema's Kerkorgelbouw, van Baekel moved the workshop to Hillegom; his first new organ was for Laren, St. John's Cathedral (2002).

RICHARD KASSEL

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ADLUNG, JACOB (JAKOB) (1699–1762)

German organist, composer, and theorist. A native of Thuringia (b. Bindersleben near Erfurt, 14 January 1699), Adlung rose from humble beginnings to become a musician and scholar of considerable erudition, due to his native intelligence and disciplined lifestyle. After preparatory studies in Erfurt, he matriculated at the University of Jena, where he pursued philosophy, mathematics, languages, and theology. Having already undertaken musical studies in Erfurt, he became an organ student of Johann Nicolaus Bach (Johann Sebsatian Bach's cousin), organist of the Jena Stadtkirche. Immediately upon his return to Erfurt in 1727, he won the post of organist at the Predigerkirche, upon the death of the incumbent, Johann Heinrich Buttstedt. Adlung kept this post until his death in Erfurt on 5 July 1762, supplementing his income by teaching keyboard and languages, making and selling keyboard instruments, and offering courses in philology, mathematics, and philosophy.

Although a number of Adlung's organ compositions survive, his most significant contribution to the organ rests in the extensive information about the instrument that he gives in his two major publications: *Anleitung zu der musikalischen Gelahrtheit* (Introduction to Musical Learning; Erfurt, 1758) and *Musica mechanica organoedi* (Musical Mechanics for the Organist; Berlin, 1768). Three other treatises written between 1723 and 1727 were destroyed in a fire in 1736. Information about the organ in the *Anleitung* (chaps. 6–10) is largely duplicated in the more extensive *Musica mechanica*, edited by J. L. Albrecht and Johann Friedrich AGRICOLA and published posthumously. The latter work is a compendium of knowledge about the sixteenth- and seventeenth-century organ, incorporating information from many sources, beginning with Michael PRAETORIUS's *Syntagma musicum* (1619). It includes an extensive compilation of stoplists of organs, some still extant. Since Agricola was a student of J. S. Bach, his involvement with the publication renders it particularly important for understanding the organ as Bach knew it.

The characteristics of the organ in Thuringia, as Adlung describes them, present marked contrasts to the North German (SCHNITGER) and Saxon (Silbermann) types. Characteristics include: a few reed stops, especially in the manuals; early abandonment of the Rückpositiv; proliferation of colorful stops at 8' pitch; the early appearance of narrow-scale string stops (before 1700); less concern for the case as a sound-reflecting enclosure; a predilection for prominent third-sounding ranks, both independent and as components of mixtures; less emphasis on higher-pitched stops in the pedal; and the frequent appearance of a Glockenspiel. In retrospect, it is evident that eighteenth-century Thuringian organ design was the most progressive of its time, often foreshadowing typical Romantic traits by one hundred years or more.

QUENTIN FAULKNER

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ÆOLIAN COMPANY

American manufacturer of musical instruments (1878–1932), most for residential use. Virtually every instrument the firm sold (pianos, reed organs, pipe organs) was equipped with a player mechanism. Æolian's organ division built almost nine hundred instruments. During its last years of business, the division produced distinguished organs that fused American and English ideals of tonal philosophy. This division of the Æolian Company merged with the Skinner Organ Company in 1932 to become the ÆOLIAN-SKINNER ORGAN COMPANY.

From approximately 1895 to 1930, the Æolian Company of New York was among the largest manufacturers of musical instruments in the world, with four factories, numerous music halls, and representation in every major city on the globe. The company began life as the Mechanical Orguinette Company in 1878, producing the Musical Wonder, a tabletop, hand-cranked, self-playing reed organ. After renaming itself Æolian in 1887, the firm expanded its product line to include the self-playing Orchestrelle (1890), a REED ORGAN that operated on compression rather than the more common suction mechanism, and the Pianola(1900), a felt-fingered piano player that could be rolled up to any keyboard. The latter yielded enormous profits, which Æolian used to market its entire line heavily. In 1913, it unveiled its latest creation: the Duo-Art, a piano that reproduced, to a considerable measure, the touch and nuance of an artist‘s performance. Unlike the Pianola, the Duo-Art was installed inside a piano. Æolian soon signed an agreement with Steinway to outfit six hundred pianos a year with the Duo-Art mechanism.

Æolian's first residence PLAYER PIPE ORGAN was produced in 1895 for Oliver H. B. Belmont of Newport, Rhode Island. The organ was actually a FARRAND AND VOTEY to which Æolian added a player for semiautomatic operation. In 1899, Farrand and Votey ended its partnership; Edwin Scott Votey (1856–1931) continued to build pipe organs, merging with Æolian in 1900. A relatively unknown figure, Votey was a highly inventive designer responsible for many fascinating concepts in pneumatic technology. Æolian established an organ factory in Garwood, New Jersey, where it built approximately 890 organs using VENTIL windchests of Votey's design. However, Votey left in 1902 to work for George S. Hutchings in Boston. Other notable personalities in Æolian were Frank Taft (1868–1955), managing director; Leslie N. Leet (d. 1963), a former Skinner supervisor who arrived in 1924; Eugen Braun, chief voicer; and William L. Alfring, president during the 1920s.

Æolian's tonal philosophy, though entirely symphonic in nature, mixed in some unusual throwbacks to the nineteenth century. Wind pressures were low, ranging from 3-1/2" to 5" for all manual divisions, except Solo organs, typically on 8". Unification was extremely rare, even on the small Pedal divisions. However, duplexing was extensively employed in smaller organs; an entire division might be made available on two manuals. While most pipe constructions followed ordinary American practices, Æolian had its share of specialty treatments. Among these were small-scaled tapered diapasons, flutes, and mixtures; open wood flutes with dropped languids; consistent use of string-scaled Comets; Oboes with short-length bass resonators; free-reed Clarinets; Vox Humanas enclosed separately in boxes to refine their tone; and, in its early instruments, labial French Horns. These various restrained voices converged into an orchestral gentility quite unlike other American pipe organs.

From 1900 to 1917, the automatic players operated only the notes, while stops and swells were worked manually. Large organs featured two consoles: a standard console for normal playing and an Æolienne, identical to the main console but with a roll player instead of keyboards. In 1917, Æolian introduced the Duo-Art reproducing pipe organ, a fully automatic player that controlled notes, stops, and expression. Some rolls were advertised as "hand-played," and were offered as faithful records of the work of great artists. The rest were transcriptions of symphonic works, operatic airs, light classics, and popular tunes, prepared by staff technicians known as the Æolian Organ Guild. A few famous conductors, including Leopold Stokowski, directed the interpretation of some symphonic rolls. Composers, including Camille Saint-Saëns and Edwin H. Lemare, wrote pieces specifically for the Duo-Art that could not actually be performed by a person.

To counter alignment problems between the roll (15-1/4" wide) and tracker bar (tracking 176 holes) caused by seasonal humidity changes, Æolian devised a tracker bar divided into seven sliding sections; mechanical "ears" at either end measured the roll width and matched the bar's width to the roll's. In the late 1920s, Æolian developed the Concertola, a mechanically controlled device that allowed the listener to choose from among ten rolls placed on a miniature Ferris wheel, using a handheld controller. The Concertola would then find, thread, play, and rewind the selection, then move on to the next one. Uninterrupted recitals of up to ninety minutes in duration were now possible, long before the automatic changer was developed for the phonograph record.

The Duo-Art player was designed to control a two-manual, thirty-stop specification of Great, Swell, Echo (playable from the Swell), and Pedal divisions. Ten of the twenty-six stops were strings. The arranged rolls often combined strings, flutes, and woodwind-type reeds to create a light orchestral tutti. Diapasons and Trumpets were used sparingly, or were reserved for sforzando effects. In moderately sized Æolians, the Duo-Art assigned a separate rank for each item on its stoplist. Duo-Arts on large organs were equipped with piano, mezzo, and forte controls. While piano might allow the Duo-Art to engage softer single stops, forte would draw together several stops of similar tone, thus making use of the entire instrument. Æolian stop nomenclature evolved, starting from typical stopnames of the trade (1900–ca. 1904), then shifting to an "Italian phase," with Oboe becoming Oboe di Caccia, Aeoline changing into Pastorita, and String Mixture V rechristened as Serafino V. During the early 1910s, the firm switched to a strictly functional description: tone family, dynamic indication and/or pitch indication. Pastorita, née Aeoline, was now String PP; Gamba became String F; Gamba Celeste turned into String F Vibrato. 16' stops were called Deep, 4' and 2' stops were called High; unison pitch was otherwise assumed. Thus, a family of flutes would be Deep Flute 16, Flute MF, and High Flute 4.

Self-playing instruments of all types experienced a great popularity from 1880 to 1925. During the years 1917 to 1927, the entire Æolian firm realized upward of $11 million in gross sales annually, with pipe organ sales occasionally responsible for over $1 million annually. With the prestige of its Steinway association, its many concert halls, and its broad customer base from piano sales, Æolian commanded the residential organ market. Ultimately, the market for such fantastic home appliances could not be sustained. The automatic musical instrument market peaked in 1923, and then began to decline considerably. By 1928, Æolian found itself in considerable debt. To broaden its market, the pipe organ department created a separate division called Æolian-Votey. In October 1927, noted organ designer Robert Pier Elliot was hired to assist in the transition. Though he stayed only one year, Elliot's tenure changed Æolian's outlook and tonal philosophy. He instituted the use of high-quality pitman windchests, which were easier to service and restore and had much faster and quieter stop action than the previous ventil design. He also encouraged the use of English-style flue and reed choruses; Æolians between 1928 and 1931 featured especially brilliant reeds, mixtures, and integrated ensembles. Notable installations were the Westchester County Center, New York (op. 1647, 4/65, 1930), the sizable concert organ for Pierre S. duPont at Longwood Gardens, Pennsylvania (op. 1726, 4/143, 1930), and Duke University Chapel in Durham, North Carolina (op. 1785, 4/120, 1932), the last organ to be completed under Æolian supervision.

Despite these last efforts, the Æolian pipe organ division continued to operate unprofitably. In January 1932, the division merged with the Ernest M. Skinner Organ Company of Boston to form the Æolian-Skinner Organ Company. Æolian contributed rough materials, Duo-Art master rolls, ready-for-sale production rolls, contracts in progress, and $50,000 cash in exchange for 40 percent of Æolian-Skinner stock; Skinner received the remaining 60 percent. All production continued at the Skinner plant in Boston, while Æolian's Garwood factory was closed. The new company was basically the Skinner firm continuing under a different name, however. Some of Æolian's mechanical designs were incorporated into the Skinner chest and console mechanisms; otherwise, the Æolian name, like the prosperous era in which it had flourished, faded into history.

JONATHAN AMBROSINO

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ÆOLIAN-SKINNER ORGAN COMPANY

American organ-building firm. Based in Boston, Æolian-Skinner was a dominant force in organ building from 1932 to 1960. Guided by tonal director G. Donald

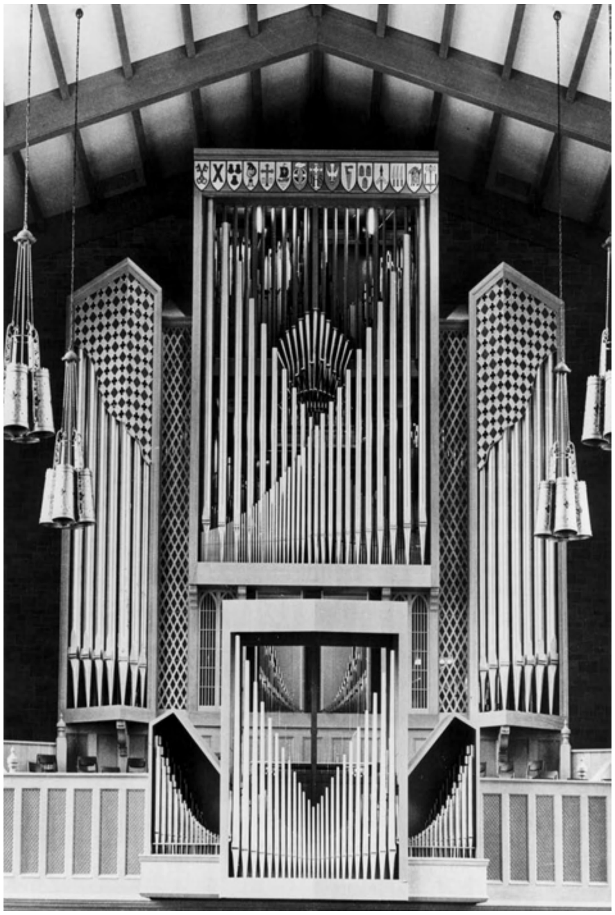

Fig. 10. Aeolian-Skinner organ, op. 1413 (4/70), Alice Millar Chapel, Northwestern University, Evanston, Illinois.

Harrison, the company instituted a move away from symphonic tonal designs to the eclectic principles of the "American classic" style. The company produced approximately 650 organs and rebuilt several hundred more.

The Æolian-Skinner Organ Company was formed on 1 January 1932 by the merger of the Skinner Organ Company of Boston and the pipe organ division of the Æolian Company of New York. Prior to this alliance, each firm had occupied the premier position in its respective field: Æolian was the elite residence organbuilder and Skinner was the aristocratic church and concert organbuilder. Arthur Hudson Marks (1874–1939), president of the Skinner firm, became president of Æolian-Skinner, while Ernest M. Skinner became vice president. Æolian's managing director, Frank Taft (1868–1955), and president, William Aifring (d. 1937), were listed as vice presidents. All production was continued at the Skinner plant in Boston, while Æolian's Garwood, New Jersey factory was closed. Gradually, some of Æolian's mechanical designs were incorporated into the Skinner chest and console mechanisms, resulting in more of a hybrid instrument than has usually been assumed. Additionally, the Skinner player system was discontinued, and Æolian-Skinner exclusively marketed Æolian's Duo-Art.

From a tonal standpoint, however, Æolian-Skinner continued as if the merger had never occurred. The company continued its development of "classic" ensembles, which had occupied Skinner since 1924 and assistant general manager Harrison since his coming to the company from England in 1927. Realizing that Harrison was more in tune with current trends, Marks unseated the sixty-five-year-old Skinner. After much argument and resistance, Skinner was stripped of power in July 1933. He fulfilled his contractual obligations to the firm through January 1936 and then established the Ernest M. Skinner and Son Company in Methuen, Massachusetts.

Meanwhile, Harrison became known as an agent of tonal reform among younger organists and enthusiasts, a group pressing for advancement along "classical" lines. Harrison's end goal was clarity, but of his own type. Above all, he strove to build an organ on which the listener could hear the movement of inner voices in polyphony. He advocated complete Diapason choruses on all manuals, reed choruses that did not dominate fluework, independent Pedal divisions, low wind pressures, and more unenclosed pipework. In his earlier designs (Cambridge, MA, Harvard University, Memorial Church, 1933, 4/118; New York, St. Mary the Virgin, 1932–33, 4/69; Worcester, MA, All Saints, 1934, 4/103; San Francisco, Grace Cathedral, 1934, 4/89; New Haven, CT, Trinity Church, 1935, 3/69) Harrison distilled nineteenth- and twentieth-century English and American ideas into a clear statement of an Anglo-American tonal philosophy. In the fall of 1935, Harrison moved one step away from his English heritage toward a more individual statement. The Æolian-Skinner organ for the Groton (Massachusetts) School, St. John's Chapel (1935, 3/86) contained an all-flue Great with twin Diapason choruses and three mixtures, a Swell (containing small-scale chorus reeds that employed French-style dome-head shallots), a Choir with a minor reed chorus, Harrison's first unenclosed Positiv, and a fourteen-stop independent Pedal. Wind pressures ranged from 2" to 4". Four months later, Æolian-Skinner installed a similar instrument at Boston's Church of the Advent (1936, 3/76); this organ was to be Æolian-Skinner's consummate showpiece.

This pattern of tonal design—enclosed and reedless Great and Positiv, enclosed Swell and Choir, independent Pedal—became the foundation for all important Æolian-Skinner organs. Meanwhile, Harrison pursued further neoclassical avenues. He developed a family of wide-scale cylindrical and tapered flutes, based on German scales supplied by Hans Steinmeyer via Henry Willis. From 1937 well into World War II, Harrison experimented with modern versions of older German solo reeds such as Krummhorns, Faggots, and Rohr Schalmeis; he would eventually develop Ranketts, Dulzians, Chalumeaus, and others. In 1938, the organ for New York, Columbia University, St. Paul's Chapel, included Great, Positiv, and Brustwerk divisions in addition to the usual Swell and Choir. By 1945, his tonal philosophy had been labeled "American classic."

After World War II, Æolian-Skinner was deluged with work, including many rebuilds of older organs, especially Skinners. Among the largest contracts were the Riverside; St. Bartholomew's; St. Thomas; St. John the Divine; and Fifth Church of Christ, Scientist churches (all in New York); University of Michigan; Princeton University Chapel; St. Paul's, Chestnut Hill, Philadelphia; and St. Paul's School, Concord, New Hampshire. Harrison's self-proclaimed masterpiece was a virtually new organ for the Mormon Tabernacle in Salt Lake City (1949, 5/188). This instrument was a definitive realization of Harrison's vision of a large organ: mostly mild stops uniting into a type of grandeur that Harrison considered unattainable by other methods. The company's largest new organ produced under Harrison's direction was for the extension of the First Church of Christ, Scientist, in Boston (1952, 4/237), designed in conjunction with Lawrence I. PHELPS.

Harrison died suddenly on June 14, 1956, while finishing an Æolian-Skinner rebuild of the Skinner instrument at New York's St. Thomas. Joseph S. Whiteford (1921–1978), who had joined the company in 1948 as stockholder and vice president, replaced Harrison as president and tonal director. Whiteford's tonal designs were much like Harrison's, although he favored a different overall sound, preferring unnicked flues of definite articulation, somewhat lower pressures than Harrison, a greater use of tapered Principals and strings, intense and fiery chorus reeds, and a generally slim-scaled ensemble. Notable instruments produced under his direction include the Independence, Missouri, Reorganized Church of Latter-Day Saints; the Buffalo, New York, Westminster Presbyterian Church; and New York City's Philharmonic (now Avery Fisher) Hall.

Æolian-Skinner's last years were fraught with economic difficulties. Citing health reasons, Whiteford retired in 1960, but remained chairman of the board and tonal director. John J. Tyrrell served as president from 1960 until 1966, when Whiteford withdrew financial support. Tyrrell was succeeded by Donald Gilett, an Æolian-Skinner tonal finisher since the early 1950s, and vice president from 1963. Æolian-Skinner's final tonal director was Robert Sipe, a mechanical action builder brought into the firm by Texas investor E. David Knutson in 1970. Æolian-Skinner produced seven tracker organs before a dwindling of capital necessitated a reorganization to avoid bankruptcy in 1972. Although the firm defaulted on no contracts, this was essentially the end of the company.

In American organ building, the Skinner Company reigned supreme from 1905 to 1932, followed by Æolian-Skinner from 1932 to around 1960. Harrison's "American classic" organ successfully captured the spirit of that period's musical practice, and was still well-suited to church playing. Harrison's eclecticism was only loosely based on historical precepts. His larger concern was to create an organ upon which many schools of organ literature would sound clear and plausible, if not always authentic. For Harrison, this meant following the spirit, if not the letter, of several schools of design, refining, and combining the historical tonal elements in ways which suited his multiple purposes. Along with Walter Holtkamp, Æolian-Skinner was the dominant force in organ design after 1945, and the finest of their instruments continue to influence builders today.

JONATHAN AMBROSINO

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AEOLINE

A string stop of very soft tone; considered by some to be the softest string tone in the organ. It is usually found at 8' pitch, but 4' and 16' examples are sometimes found. As a flue stop it first appeared around 1820 in Germany, and soon became popular in Germany, Switzerland, and North America in both large and small instruments. Different sources variously describe the Aeoline as belonging to the Gamba, Salicional, or Viol family. The degree of "stringiness" varies between different examples, being more stringy in German examples. Audsley considered it an Echo Salicional or, if voiced with a more stringy tone, an Echo Viola da Gamba. The Aeoline is often used as one rank of a Celeste. Audsley and Carl Locher claim that it is often used with the Voix Celeste, though that stop is usually intended for use with the louder Salicional.

The term *Aeoline* was also used as early as 1815, mainly in Germany, for a free-reed stop of 8' or 16' pitch and soft tone. It was sometimes made without resonators, as with the Physharmonika, or with small bells or conical resonators. According to Wedgwood, it had thin, narrow tongues, and its tone resembled a soft Oboe. While some early sources describe it as being imitative of the aeolian harp, Bonavia-Hunt reports that the Aeoline was "a form of accordion introduced by Wheatstone before the concertina." Synonyms include *Aeolian*, *Aeolina*, *Äoline*, *Êoline*, and *Eolina*.
See also **Stop**

EDWARD L. STAUFF

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AFRICA

The second largest continent has had comparatively little use for the pipe organ. Although a Hellenic Alexandrian named CTESIBIUS (Ktesibios) is credited with the invention of the hydraulic organ (ca. 300 BCE), the impact of this creation went north- and eastward. By the time Muslims conquered Africa north of the Sahara Desert (seventh century CE), there were no traces of the Greek and Roman hydraulis.

Colonization by European countries during the nineteenth century imposed arbitrary boundaries on indigenous kingdoms and peoples; it also brought missionaries, and the small churches they set up made use of reed organs. More permanent installations were limited to cities where European Christians were numerous and wealthy enough to support them. Most of these churches were in SOUTH AFRICA, originally a group of colonies dominated by the Dutch (Boers) and British before the Union of South Africa was declared (1910). Anglican and Reformed churches were and have remained important to South Africa's social fabric, even with the end of apartheid. Of the black-dominated African nations, NIGERIA has shown the greatest interest in Western organ music, with or without indigenous influences as a factor.

In the area north of the Sahara, the presence of pipe organs was intended almost exclusively to meet the needs of colonists. In Egypt, Gustave Flaubert reported hearing a midnight Mass in Latin in a distinctly non-European setting, to the "lilting tunes" of an organ (*Carnets de Voyage*, 24 Dec 1849 entry). A century later, Marilyn Mason became the first American organist to perform in that country. There have been organs at both the old and present All Saints' Cathedral in Cairo.

Aristide CAVAILLÉ-COLL built two small instruments for North Africa: Algiers, Protestant Church (1852) and Tunis, Cathedral (1883). His successor, Charles Mutin, built six organs for Algeria; only two have survived. One of these, now at the Basilique Notre Dame d'Afrique in Algiers, was originally purchased in 1911 (during the French occupation) by an Englishman named Wendell, who intended it for a large house that he had transformed into a Moorish palace. On the advice of Camille Saint-Saëns (who lived nearby), Wendell purchased a pneumatic-action instrument with a BARKER LEVER (3/25) and stops that allegedly resembled the sounds of Arab instruments. After Wendell's death (1930), his widow donated the instrument to the Basilique Notre Dame d'Afrique, which erected a special platform for it. Over the years, the organ became practically unplayable; weather extremes had damaged the wood further. The diocese raised money for repairs (begun 1998); restored in 2002, it is now used in recordings. The situation is more dire in the Sudan, occupied by Egypt and Britain (in turn or in league) until the 1950s. At Wad-Medini, St. Paul's, the lid of the nonfunctioning organ was recently lifted to reveal a lizard scurrying across the keys.

The region with the most pipe organs, southern Africa (i.e., south of the Congo River Basin), includes areas once colonized by the British (Malawi, Zambia, Zimbabwe), French (Madagascar), Belgians (Congo, formerly Zaire), Germans (Namibia), and Germans replaced by the Belgians (Rwanda) or the British (Tanzania), in addition to South Africa.

In Lilongwe, Malawi, there is an organ to accompany the congregation at St. Peter's Guesthouse. In 1996, the Cathedral of the Holy Cross in Lusaka, Zambia, brought in an organ by "C. Lloyd of Nottingham" (active from the 1860s to the 1900s), built around 1884 (2/25; mech./electro-pneum.); like most pipe organs in Africa, it has been affected adversely by the weather and lack of maintenance professionals nearby. There is also an organ at All Saints' Church in Mbala (Abercorn), Zambia. Zimbabwe (formerly Rhodesia) has the greatest presence of pipe organs in this formerly British region. In Harare, there are organs at St. Mary's Cathedral, a two-manual NORMAN AND BEARD; Highlands Presbyterian, a 1897 two-manual HILL AND SON (orig. South Africa, Bloemfontein, Cathedral); and Sacred Heart Cathedral, an 1928 Casavant. Also in Zimbabwe, Bulawayo, St. John's Cathedral, there is a 1914 Norman and Beard.

Antananarivo, Madagascar is a typical setting for examples of African "world music" with connections to organ playing The well-known popular band Tarika

Sammy has been active since the 1980s; in addition to being surrounded by music since birth, one member, Tiana, had a father who played organ in church. The guitarist Etienne "Bouboul" Ramboatiana, a leading representative of the country's booming string-playing scene, was the organ player of Andohalo Cathedral but moved on because of the poor income.

Namibia, known as Southwest Africa during South Africa's post-German occupation, has Wilhelm Sauer organs in Windhoek, Christuskirche (1897) and Swakopmund, Lutheran (1897), as well as an organ by the South African builder Fehrle at Windhoek, Dutch Reformed, Pioniesrpark (1980). A visitor to Rwanda in 2004 noted that after decades of civil war he had "yet to see a working piano or organ" there.

A few new pipe organs have been exported to southern Africa in recent years. The instrument Oberlinger built for the Palace Church of President Mobutu Sese Seko in Gbadolite, Zaire (now Congo; 1988; 2/29) may not have survived that leader's overthrow in 1997. More promisingly, a German missionary named Reiner Kammleiter turned his organ-building skills into a program at the Evangelical Lutheran Vocational School in Hai, Tanzania. Since the mid-1980s, he and his students have built instruments using readily available, highly valued materials such as African hardwoods (now used by many builders outside Africa), sheepskin leather for bellows, and cowhorn for keys. He has built several organs for Tanzanian churches (Dar es Salaam, Msasani Lutheran, 1/17); and one instrument was sent to Rothenburg, Germany, Friedhofskirche (2/14).

However, contemporary southern Africa reflects a much greater trend: the importation of electronic organs from worldwide manufacturers. The Allen Organ Company of Macungie, Pennsylvania, for example, has installed two-manual digital organs in Keetmanshoop (Namibia), Dutch Reformed, and Harare, Nazareth House. Smaller electronic organs for churches and portable instruments for use in popular music have all but eliminated the market for pipe organs. Whatever the difficulties in repairing or getting replacement parts for these instruments (and their vulnerability to atmospheric conditions), the maintenance of electronic organs is far more practical than purchasing a pipe organ from abroad or, even more unlikely, setting up shop to build organs locally.

The final area of discussion, central Africa (sub-Saharan, but north of the Congo Basin), has had pipe organs in Freetown (Sierra Leone), St. Charles Methodist, and Namirembe (Kampala, Uganda), St. Paul's Cathedral. More recently, Sauer built a positive for a Ghanaian destination (before 1990). A 1955 Walker organ is installed at Nairobi (Kenya), All Saints Cathedral. But the trend toward electronic organs has been in evidence as well; Allen installed a new-generation, three-manual instrument in Yamoussoukro (Ivory Coast), Basilique Notre Dame de la Paix in 1989.

Attempts to preserve old instruments have suffered from lack of funding and local interest. One emblematic example involves the former hunting lodge of one Lord Egerton of Knutsford (UK), located in Nakuru, near Nairobi. In 1951, Egerton installed an instrument, by Jack Davies and Son of Northampton, converted into an Æolian Duo-Art roll player piano. Egerton sold the estate to the Kenyan government before his death in 1958. The Kenyan Museum Service took the building over in 1995; a visit since that time revealed that both house and organ had suffered considerable deterioration. As happens so often in the organ world, a plea for assistance now occupies an Internet website.

Richard Kassel

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AGATI

Italian family of organbuilders. After working as an apprentice with Tronci in Pistoia and Filippo Gatti in Bologna, Pietro Agati (b. Pistoia, 15 Feb 1735; d. there, 10 Dec 1806) opened his own workshop in Pistoia in 1759. He is known primarily for his organs in San Vitale (1760) and Vignole di Quarrata (1797), the latter representing Pietro's most complete extant organ. Over the years, however, the organ at Vignole, which Agati evidently modeled after Willem Hermans's organ at Spirito Santo, Pistoia (1664), was restored by Filippo Tronci in 1887, Carlo Paoli in 1893, and Fratelli Ruffatti. The original forty-seven-key manual is still intact, but the entire stop-action mechanism was rebuilt (by Tronci) and a more modern pedalboard added.

Giosuè Agati (b. Pistoia, 21 Jan 1770; d. there, 10 Dec 1847), son of Pietro Agati, carried on the firm's name, making it known to the public in 1835 that he could "beat any price presented by other firms." He built several fine organs including those at the Oratorio di SS Trinità, Límite sull'Arno (1821), Serravalle Pistoiese (1822), and Gavinana, Pistoia (1838). In addition to building organs, Giosuè modified Giuseppe

Testa's organ at Popiglio, S. Maria (1665) in 1823, rebuilding the windchest and adding trumpets.

The last of the Agati organbuilders was Nicomede Agati (b. Pistoia, 8 April 1796; d. there, 16 May 1885), son of Giosuè. He built a number of smaller organs including those at Fucecchio, Collegiata (1849), Pescia, S. Antonio (1853), and Pistoia, S. Chiara (1877). Nameplates on many of the organs indicate that his younger brother Giovanni Agati (b. 28 Jan 1798; d. 1876) and nephew Luigi Agati (b. 8 March 1861; d. 23 Feb 1883) assisted him. With no heirs to carry on the firm, however, Nicomede sold the firm to his competitor Filippo Tronci in 1883, requiring that the new firm be named Agati-Tronci. The firm continued to build organs until 1919.

The Agati family produced some five hundred organs throughout Italy and abroad, including those at Santo Sepolcro in Jerusalem; the Colon Theater in Buenos Aires; and in France, Corsica, Chile, and Egypt.

THOMAS CIMARUSTI

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AGRICOLA, JOHANN FRIEDRICH (1720–1774)

German composer, organist, conductor, singing master, and writer on music. Agricola entered the University of Leipzig in 1738 to study law and subsequently became a student of Johann Sebastian Bach. In 1741 he settled in Berlin and studied with Johann Joachim Quantz, and later with Carl Heinrich Graun and Johann Adolf Hasse. He became court composer to Frederick the Great in 1751, assuming the role of musical director of the opera at the death of Graun in 1759. Italian operas, German sacred oratorios and cantatas, lieder, keyboard pieces, and chorale preludes comprise much of his output. While Agricola's music was constantly criticized by Frederick, his work remains significant. Highly regarded as a singing instructor, Agricola translated and annotated Francesco Tosi's treatise on singing (*Anleitung zur Singekunst*, 1757). Charles Burney related that Agricola was the best organ player in Berlin and the best singing master in Germany.

Agricola distinguished himself as a transmitter of biographical information on Bach and insight into the performance of his music. Together with Carl Philipp Emanuel Bach, he published the elder Bach's obituary ("Nekrolog," 1754) in Lorenz Mitzler's *Neu eröffnete Musikalische Bibliothek*. This document reveals a great deal about Bach's musical beliefs and personal views of both himself and other figures of the day. It is also an important source for Bach and the organ that placed the composer's contributions in perspective, and served as a basis for future biographies.

In 1768, Agricola and J. L. Albrecht published an annotated edition of the *Musica mechanica organoedi* of Jacob ADLUNG, incorporating what he had learned about organ construction and design from Bach. In the commentary he relates Bach's views on organ building and registration, performance practice, and composing for the instrument. Specifically, Bach's own attitudes are revealed: his enthusiasm for reeds, especially those of French instruments; his opinion on low-pitched (32') stops; his preference for keyboards with shorter, narrower keys, and pedalboards that allowed for easier use of heel and toe; his views on Silbermann's pianofortes; and a description of the *Lautenclavicymbel* (lute-harpsichord). Agricola also brings into question, through specific criticisms, the idea that the organs of Gottfried SILBERMANN were ideal for Bach's music.

Agricola mediated the aesthetic debate between Friedrich Willhelm Marpurg and Georg Andreas SORGE. In his writings, he promoted Italian music, in the face of Marpurg's advocacy of the French style, under the pseudonym Flavio Anicio Olibrio. His articles and criticisms that appeared in Friedrich Nicolai's *Allgemeine deutsche Bibliothek* reflect a conservatism typical of northern German thought of the day.

BRIAN DOHERTY

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AHREND, JÜRGEN (B. 1930)

German organbuilder. Born in Göttingen on 28 Apr 1930, Ahrend apprenticed with Paul OTT there (1946–49) before joining the firm as an employee. In 1954, he formed a partnership with another Ott apprentice, Gerhard BRUNZEMA, in Leer-Loga, East Frisia. Ahrend and Brunzema produced fifty-four new instruments and undertook nineteen restorations. In January 1972 Brunzema left the firm to begin an organ-building career in Canada.

Since the partnership's dissolution, Ahrend's firm has been involved in over 150 projects, including restorations. Newly built organs have been installed at Eugene, University of Oregon (1972; 4/38), University of Edinburgh (1978; 2/21), Melbourne, Monash University (1979; 4/45), Tokyo, St. Gregory House (1986; 2/13) and six instruments for Berkeley, University of California (between 1975 and 1981).

Ahrend incorporates several historical organ-building techniques into his instruments: (1) hand hammering the metal before it is formed into pipes (Bremen-Farge, Reformierte Kirche, 1957), designed to tamp the metal into a closer molecular structure and irregular surface that may help improve the tone, even speed up the ageing process to achieve the fine tone characteristic of the best historical instruments; (2) suspended action (Frankfurt-Nordweststadt, Cantate Domino Kirche, 1970), felt to have more precise touch control and lighter weight than the balanced action used in northern European–type tracker instruments built during the Romantic and ORGAN REFORM MOVEMENT eras; (3) flexible wind, supplied by weight-loaded (rather than spring-loaded) wedge bellows (Westerstede, 1971), rather than the steady, heavily regulated wind supply characteristic of twentieth-century instruments; (4) unequal temperaments (Eugene, University of Oregon, 1972); and (5) compact, simplified consoles, with narrow octave spans and short keys and pedals, lacking all registrational aids.

Restorations account for about half the workshop's time, and Ahrend is much admired for his ability to recognize and retain the salient characteristics of the original instruments. Restorations of the seventeenth-century organ at Westerhusen (1955; 1/7) and a Renaissance organ at Rysum (1961; 1/7) led to larger contracts. Significant restorations include the Ebert organ at Innsbruck, Hofkirche (1976; 2/15); the Huss/Schnitger organ at Stade, SS Cosmae & Damiani (1974; 3/42); the 1736 Erasmus Bielfeldt organ at Stade, St. Wilhadi (1988–90; 3/40); Arp Schnitger organs at Groningen, St. Martini Kerk (1984; 3/53, 32'), Norden, St. Ludgeri (1985; 4/46), and Hamburg, St. Jakobi (1993, 4/60); the 1714 Sieber organ at Vienna, Michaeler Kirche (1987; 3/40); the 1616–17 Esajas Compenius organ at Frederiksborg Castle, Hillerød (collab. M. Kjersgaard, 1988). and the 1741 Joachim Wagner organ in Trondheim (Norway) Cathedral (1994; 2/30).

JOHN HAMILTON

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ALBERDI RECALDE, LOPE (1869–1948)

Spanish organbuilder of Basque origin. Born in Gauteriz de Arteaga, Vizcaya, on 25 September 1869, Alberdi Recalde was apprenticed to Aquilino Amezúa in Barcelona in 1885, became director of the firm in 1895, and took over entirely the following year. He was assisted by his sons Antonio Alberdi Aguirrezábal (1893–1986) and Luis Alberdi Aguirrezábal. Active for over fifty years, Alberdi Recalde built over two hundred organs, including instruments in the abbey at Montserrat, the Jesuit church in Madrid, the Gerona and Santiago cathedrals, La Seu d'Urgell in Catalonia, and several in Spain's Basque country (Bilbao, S. Nicholas; Bergarar, Andra Mari; Guanaco; Bera). He collaborated with one Martí on organs in Navarra (Echalar, S. María, 1902) and Toledo (Talavera de la Reina, Colegio Compañia de María, 1905). A builder of high-quality instruments, Alberdi Recalde was considered advanced technologically, using mixed mechanical systems, replacing pneumatic with electric action, and avoiding the use of sliding valves. His organs found their way to South America and the Philippines. He died in Barcelona on 19 March 1948.

RICHARD KASSEL

ALEXANDRE

French reed organ manufacturer. Founded in 1829 by Jacob Alexandre (b. Paris, 1804; d. there, 11 June 1876), it was originally intended for the production of accordions. As early as 1834 the firm exhibited a small REED ORGAN with two ranks of reeds, and the line soon expanded, particularly with the purchase in 1841 and 1845 of the reed organ patents of Louis-Pierre Alexandre Martin of Provins. Jacob Alexandre was joined by his son Édouard Alexandre (d. Paris, 9 Mar 1888); the firm became Alexandre, Père et Fils. Alexandre's instrument was originally called a "orgue-mélodium" (introduced 1844) to avoid a legal clash with Alexandre François DEBAIN, inventor, patent holder, and owner of the "harmonium" trademark. Martin himself became an Alexandre partner for a time; he and Édouard were responsible for a number of innovations in the harmonium. Martin, in particular, invented the percussion action, whereby small hammers struck the reed tongues, thus assuring promptness of speech; and the *prolongement*, by means of which individual tones could be sustained.

Shortly after 1855, Alexandre built a large factory at Ivry-sur-Seine; the firm rapidly became the leading builder of harmoniums in France, winning numerous awards for excellence and innovation. Offices and showrooms were scattered across Paris. Its instruments of the period generally had four ranks of reeds controlled by a five-octave keyboard, with octave couplers, a GRAND JEU, and, most important, the expression stop, the presence of which became the hallmark of the true (compression) harmonium. This device, which bypassed the reservoir to allow direct control of the dynamic level by means of the treadles, has been credited to the Alexandres; it as well as many other improvements were widely adopted by other makers.

Ironically, it was at the Alexandre firm that the suction principle was discovered, as early as 1835, which was to change the reed organ world drastically. The firm built several organs utilizing this principle, but Alexandre was dissatisfied with their limited expressive capabilities. The invention was subsequently developed by MASON AND HAMLIN, generally thought to have been the first to produce the so-called American organ on a production basis. The Alexandre firm suffered considerably from the competition of instruments using this system, and in 1874 finally introduced an instrument utilizing the suction principle, the Alexandre Organ.

By 1878 the Alexandre firm had a factory capacity of one thousand organs per month. The firm built instruments of all sizes and varieties, and by 1898 its catalog exhibited a popular four-octave instrument called the "orgue à cent francs" as well as large three-manual and pedal instruments and all sizes in between. They also produced a church model with seven and one-half ranks of reeds, a combined reed and pipe instrument, a combination piano and reed organ, and a tiny tabletop instrument called the "mélodiflûte." Numerous reed organbuilders began their careers with Alexandre, such as Christoph & Etienne, Mustel, and Trayser. The name was continued into the 1930s by the reed organ maker G. Fortin of Paris.

JAMES HOWARD RICHARDS

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ALIQUOT

Acoustically speaking, a stop based on the partials of a given pitch, but in a manner that focuses on non-octave and –fifth partials. In general, "aliquot" denotes a "lowest prime factor"—that is, a number that divides another without remainder (e.g., 5 is an "aliquot part" of 10). Since wavelengths are inversely proportional to frequency, the wavelengths of the partials are aliquot-parts of the fundamental wavelength. Organbuilders apply this principle in the MUTATION stop (overtone stop, aliquot stop, *Aliquotstimme*).

Mutation stops are generally single-rank stops, with wide scaling and high lead content. They are pitched at one of the partials (third, fifth, seventh, ninth, etc.). Sometimes aliquot stops are also MIXTURES (e.g., the Tierce). In other instances, mutation stops occur in PRINCIPAL ranks, such as the Twelfth (2-2/3') and Nineteenth (l-l/3').

Widely used examples of aliquot stops are the Larigot (1-1/3') and Nasard (2-2/3' or l-l/3'); in some cases, the Rohrflöte (10-2/3', 5-1/3', 2-2/3', or l-l/3'), Septième (4-4/7', 2-2/7', or l-l/7'), and Tierce (l-3/5').

PETER G. C. VAN POUCKE

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ALLEN ORGAN COMPANY

SEE ELECTRONIC ORGAN

ALLEY, JOSEPH (1804–1880)

American organbuilder. Born in Kennebunk, Maine, on 4 Mar 1804, apparently self-taught, Alley began making reed organs at age eighteen. In 1826 he moved to Newburyport, Massachusetts, where he married Lucy B. Knowles; of their children, only Joseph Alley

II (1832–1870) is known to have followed his father's trade, working for him as a pipemaker.

Backed by local businessmen, Alley built several organs (and a few pianos) between 1826 and 1850. Three or four of these were located in Newburyport churches, while others were installed in Maine and along the Merrimack River at least as far as Haverhill, Massachusetts. At the time of his death he is said to have built thirty-seven organs, but only one is extant, in the First Religious Society of Newburyport (1834). Although twice rebuilt, the instrument still contains much of Alley's work.

In 1849 and 1851, in conjunction with Henry Ward Poole (1826–1890), Alley built two experimental "euharmonic" organs, which, by means of added pipes and shifting pedals, were said to play in pure (just) intonation, sounding untempered intervals from a normal keyboard. While Alley and Poole had high hopes for the commercial success of their invention, only two instruments were ever made, and both were sold at a loss. Neither man ever gave up the dream of a purely tuned organ, and when Poole returned briefly in 1868 with a design for a thirty-six-note keyboard, Alley built a small reed organ to his design. Otherwise, Alley gave up his workshop and spent the remainder of his life making pipes for other builders. He died in Newburyport on 8 March 1880.

BARBARA OWEN

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ALSACE

The most eastern region of France; its major cities include Strasbourg, Colmar, and Mulhouse. Alsace was part of the Holy Roman Empire until the seventeenth century, and was ceded to Germany after the Franco-Prussian War (1871–1918). One result is that builders from both countries were active there, producing a unique blend of characteristics. The Alsatian organ style follows the French classical tonal design but with fewer reed stops and a German-style independent Pedal. In Strasbourg, the SILBERMANN family shop (Andreas, Johann Andreas, Johann Daniel) was active from 1699 to 1781. The Callinet family in Rouffach (François, Joseph, Claude-Ignace, Louis, Louis-François) was active in the nineteenth century for various firms (including DAUBLAINE-CALLINET). After Joseph Callinet's death in 1857, Claude-Ignace Callinet modified his style by trying new stops and techniques. Joseph's foreman, François-Antoine Berger, set up his own shop and continued the Callinet tradition, pursued by his son and grandson, Joseph-Antoine Berger and Alfred Berger. Edmond-Alexandre ROETHINGER (1866–1953) founded Maison Roethinger and built Italian-style organs with low wind pressure. A number of the instruments used pneumatic action, but Max Roethinger (1897–1981) returned to tracker action after 1960. Georges Schwenkedel (1885–1958) and Ernest Mulheisen (1897–1981) left Maison Roethinger in 1921 to create Maison Schwenkedel. In 1941, Mulheisen made the changeover to building neobaroque organs; the company, now called Muhleisen G. Walther et Associés, is run by Georges Walther. Ernest Muhleisen's brother-in-law, Alfred KERN, founded a company in Strasbourg in 1953.

Important Alsatian organs include the Andreas Silbermann organs at Marmoutier, St. Étienne (1709; 3/28) and Ebersmunster, St. Maurice (1732; 3/28); the Johann Andreas Silbermann organs at Strasbourg, St. Thomas (1741; 3/38; reconstr. Kern, 1979) and Soultz-Haut-Rim, St. Maurice (1750; 3/31); Mollau, St. Jean Baptiste (Joseph Callinet, 1833; 2/26); Mulhouse, Temple St.-Etienne (Cavaillé-Coll, 1863; 4/52); and Fréland, Assomption de la BVM (Louis-François Callinet, 1877; 2/28).

See also **France; Organ Reform Movement; Schweitzer, Albert**

HEATHER HERNANDEZ

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ALTERNATIM

In the European Latin liturgy, a procedure in which a specific piece is divided between distinct, generally dissimilar forces; the musical realization of a division of spoken text between leader and congregation. First practiced in unaccompanied chant, alternatim later incorporated the organ into its a cappella texture. Alternatim was first applied to responsorial plainchant (e.g., gradual or alleluia), with a solo singer (cantor) taking the opening phrase of a verse, completed by the full choir; the medieval organ may have doubled the choir or even played the chant alone in alternation. Discant organum (eleventh and twelfth centuries) alternated lively polyphonic solo sections supported by chant fragments in long note values (the cantus firmus, either sung, played on the organ or both) with plainchant choir, a texture that survived in altered form into the Renaissance.

By the time the organ was fully integrated into church performance (fourteenth century), the organist would play polyphonic settings of chant verses, usually improvised, in alternation with plainchant choir. Increasingly, other parts of the Mass (in both the Ordinary and Proper) were performed in this fashion; the procedure attained general currency by the fifteenth century, even though composers were now producing fully polyphonic sung Mass and Proper settings. While improvisation continued to fulfill the organ's alternatim role, new organ genres, notably settings of Mass passages (especially Ordinary pieces based on the corresponding cantus firmus) and hymns or versets (replacing even- or odd-numbered verses), emerged in the late medieval era and Renaissance. In a majority of cases, manuscript and published works do not provide enough music for a full complement of verses, suggesting repetition or, more likely, improvisation to complete the organ's role. Organum-like pieces gave way to greater variety of texture and less dependency on the cantus firmus. Organ alternatim survived the reform measures of the Council of Trent (mid-sixteenth century) and flourished, especially in France and Italy (and, to a lesser degree, Germany, Spain and England). By the eighteenth century, French composers were dominating ORGAN MASS and other alternatim composition; even after the Vatican banned alternatim performance in 1903, they continued to compose nonliturgical works in that tradition.

RICHARD KASSEL

ALTES LAND

Altes Land ("Old Land") is a lowland area extending seventeen miles on the southwest bank of the lower Elbe River, between the cities of Stade, Buxtehude, and Hamburg-Harburg. It is part of the Elbe-Weser region in northern Germany. The eastern extent of Altes Land has been open to question, as it has never been a political unit; it seems reasonable to name the Süder-Elbe River branch as that border.

Hamburg organbuilder Arp SCHNITGER lived in Neuenfelde and provided eight out of the ten regional Lutheran churches with new or rebuilt organs; many of these survive with original stops and other elements. Rudolf von BECKERATH started his career by taking organ measurements in the area. Altes Land was also one of the first regions to get the attention of the ORGAN REFORM MOVEMENT; restoration efforts began as early as 1938, in Neuenfelde.

Schnitger instruments are found in Neuenfelde (1683–88; rest. Ott, 1978–79); Hollern (1688–90; reb. E. Kemper, 1966–67); Steinkirchen (1685–87; rest. Beckerath, 1987); and Borstel (1677; new case, 1770–72). Schnitger cases now house instruments by KEMPER (Estebrügge, 1702; new organ, 1958–59) and FÜHRER Orgelbau (Jork, 1709; new organ, 1980–82). The instrument in Mittelnkirchen is a mélange of registers dating back to the sixteenth century, including those of Arp SCHNITGER (1688) and Jacob Albrecht and Johann Matthias Schreiber (1750–53), followed by several restorations, most recently by Beckerath (1992). Other historic instruments are in Grünendeich (D. C. Gloger, 1766; rest. Hillebrand, 1992); Twielenfleth (P. Furtwängler, 1861); Neuenkirchen (Ott, 1936); and nearby Buxtehude, St. Petri (P. Furtwängler, 1859; rest. Führer, 1983).

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ALUMINUM

Aluminum has been commercially available as a metal for only one hundred years. Previously it was so rare, exotic, and precious that it was even chosen for the point at the top of the Washington Monument in the Washington, D.C. The price eventually fell and, with new fabrication techniques, aluminum has been developed as a metal for organ pipes.

In the 1940s organbuilder Charles McManis pioneered the development of extruded aluminum organ pipes. Difficult to solder or weld, the material was problematic and saw only limited use. In the 1960s Gerhard Beisecker patented a method of joining aluminum seams on the backs of organ pipes, but the system was less than permanent and proved a dead end in aluminum pipe development, even though some ranks were sold and installed.

Technical advances in welding aluminum are responsible for a resurgence of this metal and, for the first time, organ pipes of aluminum have been fabricated with an all-welded construction. Unfortunately, the appearance of the welds on aluminum pipes is not as clean, smooth or small as on “pipe metal” (tin/lead), zinc, or copper, and many builders await an improvement in these welding techniques before such pipes are acceptable.

In the meantime, aluminum is becoming a reasonable alternative to tin in many ways. Polished aluminum pipes now rival polished tin in appearance, with the long-term stability (preserved by the instant formation of the clear aluminum oxide skin on the metal) necessary for facade pipes. Cost is another factor, with tin having become very expensive in comparison to aluminum. Finally, much exploration is being done on the possible applications of aluminum. In addition to 16 façade pipes, small pipes that would normally be made of pipe metal have been produced in aluminum.

Naturally, any new material will find slow acceptance, simply because it is not the standard tin/lead alloy, and not all builders find the sound of aluminum pipes sufficiently pleasing. Another apparent disadvantage to the all-aluminum pipe is that all constructional features must be done in aluminum, including ears, hooks, and miters; furthermore, unless special welding equipment is available, physical revisions or additions to the pipes are difficult if not impossible to make. (Doing a miter “on the job” is therefore pretty much out of the question.) The builder using aluminum pipes must work out every detail carefully in advance.

A highly pure aluminum produces the best results—a pipe that is soft and strong. Alloyed with other metals, aluminum becomes harder and more rigid, but even the softest available material seems adequate for supporting the largest pipe (one person can easily lift a 16′ aluminum Prestant). It is the near deadsoft character of the metal that brings it closer to tin/lead in sound than either zinc or copper usually does, at least to the ears of some builders.

See also **Pipe Metal**

Charles Hendrickson

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AMERICAN CLASSIC ORGAN

See Neoclassical Organ; Organ Reform Movement; United States of America

AMERICAN GUILD OF ORGANISTS

The American Guild of Organists (AGO), a national organization of organists and church musicians, was founded in 1896 in New York (on the model of Britain’s Royal College of Organists) and subsequently chartered by the State of New York as an educational association. Membership is organized by local chapters throughout the country; in 2003 there were approximately 20,000 members, spread among over 340 chapters in the United States, a European chapter, and chapters on several other continents. The annual budget exceeds $2 million. The organization conducts annual examinations designed to further practical skills in performance, conducting, and accompanying; it publishes a monthly magazine, *The American Organist* (begun as *Music Magazine* in October 1967, under its current name since January 1979), as well as other material in the field.

Originally established for the purpose of improving the quality of church music in the United States, a constitution was adopted two months after the initial organizational meeting on 3 February 1896. Gerrit Smith was the first warden and Dudley Buck the first honorary president; founders included John K. Paine and George W. Chadwick. The first chapters were established in Pennsylvania, Massachusetts, and Illinois in 1902, 1905, and 1907, respectively. The group merged with the National Association of Organists in 1935.

Membership reached 6,000 in 199 chapters by its fiftieth anniversary in 1946.

National conventions were held at various intervals following the first one in 1914 in New York, becoming biennial events after World War II. Since the 1960s these have alternated with conventions in nine regions throughout the country. A national competition in performance was founded in the 1950s; improvisation and composition competitions have since been established. The levels of certification, achieved by the passing of written and performance examinations, begin with Service Playing and range up to Fellow of the AGO. The appointment of a full-time executive director in 1978 signaled the AGO's desire to expand beyond its New York base with a volunteer organization and elected officers representative of the country at large, complemented by less stringent requirements for membership and holding office and the diminishing of examination activities. The national headquarters remains in New York.

Past official journals have been *The Pianist and Organist* (1896–99), *Bulletin of the American Guild of Organists* (1899–1901), *Church Music Review* (1901–18), *The American Organist* (1918–20), *New Music Review* (1920–35), and *The Diapason* (1935–1967, which continued as an unaffiliated publication).

See also **Organizations**

ARTHUR LAWRENCE

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AMERICAN ORGAN ARCHIVES

A specialized organ research collection that houses books, periodicals, recordings, microfilms, directories, census data, nameplates, tools, business records of firms, and extensive files pertaining to American and European organbuilders. Funded and owned by the Organ Historical Society (OHS), it is operated by Westminster Choir College, Princeton, New Jersey, and directed by a board of governors. Located at the Talbott Library at Westminster Choir College it is one of the world's largest collection of organ research materials. The archive is strong in organ periodical literature and books, and has a quantity of manuscript material. Much of the collection is cataloged in the Online Computer Library Center (OCLC) database.

The archive was organized in 1960 by the National Council of the OHS, based on the contributions of OHS members in the form of duplicate books, periodicals, and other materials. Thomas S. Eader (1931–1987) was appointed archivist, and the collection was held at the Historical Society of York County, Pennsylvania. In 1964, Homer D. Blanchard (1912–1988) became archivist; in 1967, the collection was moved to the library of Ohio Wesleyan University in Delaware, Ohio. In November 1984, Stephen L. Pinel succeeded Blanchard, who resigned for health reasons; after negotiations, Pinel was able to move the collection to its present location.

See also **Organizations**

STEPHEN L. PINEL

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AMERICAN THEATRE ORGAN SOCIETY

The American Theatre Organ Society (ATOS), organized in 1955, is dedicated to the preservation, restoration, and promotion of the THEATER ORGAN and its music. Its headquarters is in San Francisco. ATOS has grown from modest beginnings into an international society of more than five thousand members. ATOS chapters present concerts, silent film programs, and educational seminars; they also encourage young musicians to become proficient theater organists through events like the annual Young Organist Competition and through scholarships to aspiring organ students. ATOS produces a bimonthly journal, *Theatre Organ*, and a radio program, *Theatre Pipes*. Its comprehensive archives/library collection in Joliet, Illinois, is available by appointment to members, music scholars, and historians.

Some prime examples of extant American theater organs are Radio City Music Hall's Mighty WURLITZER organ (4/58) in New York; the MOLLER (4/42) in the Fox Theatre, Atlanta; the Wurlitzer (4/20, double console) at the Paramount Theatre, Denver; the AUSTIN (4/75) at Bushnell Memorial Hall, Hartford, Connecticut; the ÆOLIAN-SKINNER (4/71) at the Hershey, Pennsylvania, Community Theatre; the Barton (4/24) in the Rialto Square Theatre, Joliet, Illinois; the Wurlitzers of the Orpheum (3/14) and El Capitan (4/37) Theatres in Los Angeles; the PILCHER (4/85) in Memorial Auditorium, Louisville, Kentucky; the W. W. KIMBALL (3/38) at the Oriental Theatre, Milwaukee; the Wurlitzer (4/27, double console) at the Paramount Theatre in Oakland, California; the Wurlitzer (5/21) at the Providence, Rhode Island, Performing Arts Center; the Robert

Morton (4/23) at the Saenger Theatre, Pensacola, Florida; and the Wurlitzer (4/21) at the Castro Theatre in San Francisco.

See also **Organizations; Richards, Emerson**

Richard Kassel

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ANCHES

A term first employed in French Romantic organ building and registration; its literal translation is "reeds." But in practice, *anches* is used in a broader sense: to designate the reed ensemble of each division, which commonly included most reed stops, higher-pitched flue stops (often above 4'), and the mixtures. César Franck, Louis Vierne, Charles-Marie Widor, and other nineteenth- and twentieth-century composers used the anches to produce brilliant dynamic effects. The use of the anches is a critical aspect of French organ music of the Romantic and modern periods.

The practice of combining reed stops with select flue ranks to produce a carefully balanced reed ensemble can be traced to the Grand jeu of the French classical organ. The Grand Jeu, however, was a fully independent registration, used for *dialogues*, *points d'orgue*, and other types of majestic concluding pieces; the Grand jeu was never combined with the Principal ensemble of the time, the Plein Jeu. The idea of creating a new type of reed combination that could be added to or subtracted from an ensemble of foundation stops, or fonds, during the course of a piece, in order to create crescendos and diminuendos, was the achievement of the nineteenth-century organbuilder Aristide Cavaillé-Coll. The expressive potential of Cavaillé-Coll's innovation was convincingly demonstrated by Franck, whose *Six pièces*, published in 1868, inaugurated a new era, the age of the "symphonic" organ. Since that time, almost every major nineteenth- and twentieth-century French composer of organ music has utilized the anches concept to achieve dynamic effects.

On a Cavaillé-Coll organ, the anches stops of a division were placed on a separate windchest from the fonds, so that they could be activated independently through the use of a ventil. While the precise makeup of the anches ensembles differed slightly from instrument to instrument, Cavaillé-Coll commonly included all reeds (except the Voix Humaine and, sometimes, the Hautbois); the mixtures; the 4' Flute, Octave, or Dulciana; and all other flue stops above 4'. The reed stops were commonly harmonic—that is, the pipes contained double-length resonators in the treble to produce a rich, full sound. The flue stops, too, were commonly harmonic in the treble, with double-length pipes overblown to emphasize the fundamental.

In French Romantic practice, the anches of each division were normally "prepared" (drawn) before the playing began. (Anches drawstops were colored red or sometimes yellow, rather than black, so that they could be distinguished easily and quickly.) The anches would not sound, however, until their ventils were activated by means of *pédales de combinaison*—iron hook-down pedals that projected out from the console, just above the pedalboard—one for each division (Grand Orgue, Récit, etc.). With the manual couplers (*accouplement*) and manual-to-pedal couplers (Tirasse) activated, and the fonds of each division drawn, an organist could produce a large crescendo on a three-manual instrument by playing on the Grand Orgue and then adding the anches ensembles one by one: first, the Récit (with the swell box closed at first, then gradually opened), followed by Positif (Positiv), Grand Orgue, and Pédale (Pedal). To produce a decrescendo, the procedure was reversed. Franck meticulously notated the process of adding and subtracting the anches in the scores of his large organ works, from the *Grande pièce symphonique* of 1863 to the *Trois chorals* of 1890.

On the Cavaillé-Coll organ in Ste. Clotilde, Paris (1859), the instrument for which Franck wrote most of his music, the anches included all reed stops (except the Basson-Hautbois 8' and Voix Humaine 8' on the Récit) and flue stops of 4' pitch or higher (except the 4' Prestants on the Grand Orgue and the Positif and the Octave 4' on the Pédale). In the following stoplist, the anches components are marked with an asterisk; stops that Franck would have drawn for *tous les fonds* (i.e., all fonds stops) are marked with a plus sign:

Grand Orgue (Manual I. C-f´´´)

Montre	16
Bourdon	16
Montre	+8
Flûte Harmonique	+8
Bourdon	+8
Viole de Gambe	+8
Prestant	+4
*Octave	4
*Quinte	2 2/3
*Doublette	2
*Plein jeu VII	2
*Bombarde	16
*Trompette	8
*Clairon	4

Récit expressif (Manual III. C-f´´´)

Flûte Harmonique	+8

Bourdon	+8
Viole de Gambe	+8
Voix Céleste	8
Flûte Octaviante	4
*Octavin	2
*Trompette	8
*Basson-Hautbois	+8
*Voix Humaine	8
*Clairon	4

Positif (Manual II. C-f´´´)

Bourdon	16
Montre	+8
Flûte Harmonique	+8
Bourdon	+8
Viole de Gambe	+8
Unda Maris	8
Prestant	+4
*Flûte Octaviante	4
*Quinte	2 2/3
*Doublette	2
*Plein jeu harmonique	III-VI
*Trompette	8
*Clarinette	8
*Clairon	4

Pédale (C-d´)

Soubasse	32
Contrebasse	+16
Basse	+8
Octave	4
*Bombarde	16
*Basson	16
*Trompette	8
*Clairon	4

On larger organs (e.g., the 1862 five-manual instrument for St. Sulpice), Cavaillé-Coll counted such additional stops as the 32' Bombarde (Pédale), the Grosse Quinte 5-1/3' and Grosse Tierce 3-1/5' (Bombarde), and the Tierce 1-3/5' and Larigot 1-1/3' (Positif) among the anches.

Other nineteenth-century French builders adopted Cavaillé-Coll's fonds-anches scheme, but often approached the precise composition of the anches ensembles differently. Ducroquet and Fermis et Persil went so far as to include 8' flue stops. At the opposite end of the spectrum, Joseph Merklin, Cavaillé-Coll's chief competitor, commonly constructed an anches ensemble of reeds and mixtures only. It is noteworthy that Franck played the organs of all four builders.

See also **Mechanical Aids; Reed**

George B. Stauffer

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ANDERSEN, POUL-GERHARD (1904–1980)

Danish organbuilder. An unassuming but active figure in twentieth-century organ building, Andersen's contributions are known internationally by organbuilders and performing artists, many of whom came to Denmark to record on his instruments.

While pursuing a career as civil engineer at the Polytechnic Institute, Andersen studied organ playing. In 1926, he began his apprenticeship at Marcussen & Son in Åbenrå, Jutland. He quickly became a respected associate. In 1963, he established his own organ-building company. As a builder, Andersen occupied a position of leadership in the Danish Organ Reform Movement. The group, which included performers such as Finn Viderø and Sybrand Zachariassen, advocated a return to classical principles of organ building. In 1995, his firm merged with P. Bruhn & Son.

Andersen built new instruments, but is primarily known for his restorations, including organs in Christians Kirke, Copenhagen (1976, incorp. 1759 H. J. Müller facade); Frederiksborg Slotskirke (1972, incorp. 1864 Marcussen facade); St. Olai Cathedral, Helsingør (1969); Vor Frelsers Kirke, Christianshavn/Copenhagen (1965); and cathedrals in Lund and Skara (both Sweden).

Joanne Curnutt

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ANDOVER

American organ-building firm. The Andover Organ Company was founded in 1948 by Thomas W. Byers of Louisville, Kentucky. Byers attended Princeton University and had worked for Pilcher in Louisville and Raymond in Princeton. He wanted to build a better organ than he saw in contemporary American practice. Influenced by Arthur Howes's Organ Institute in Andover, Massachusetts, he began a new company in the

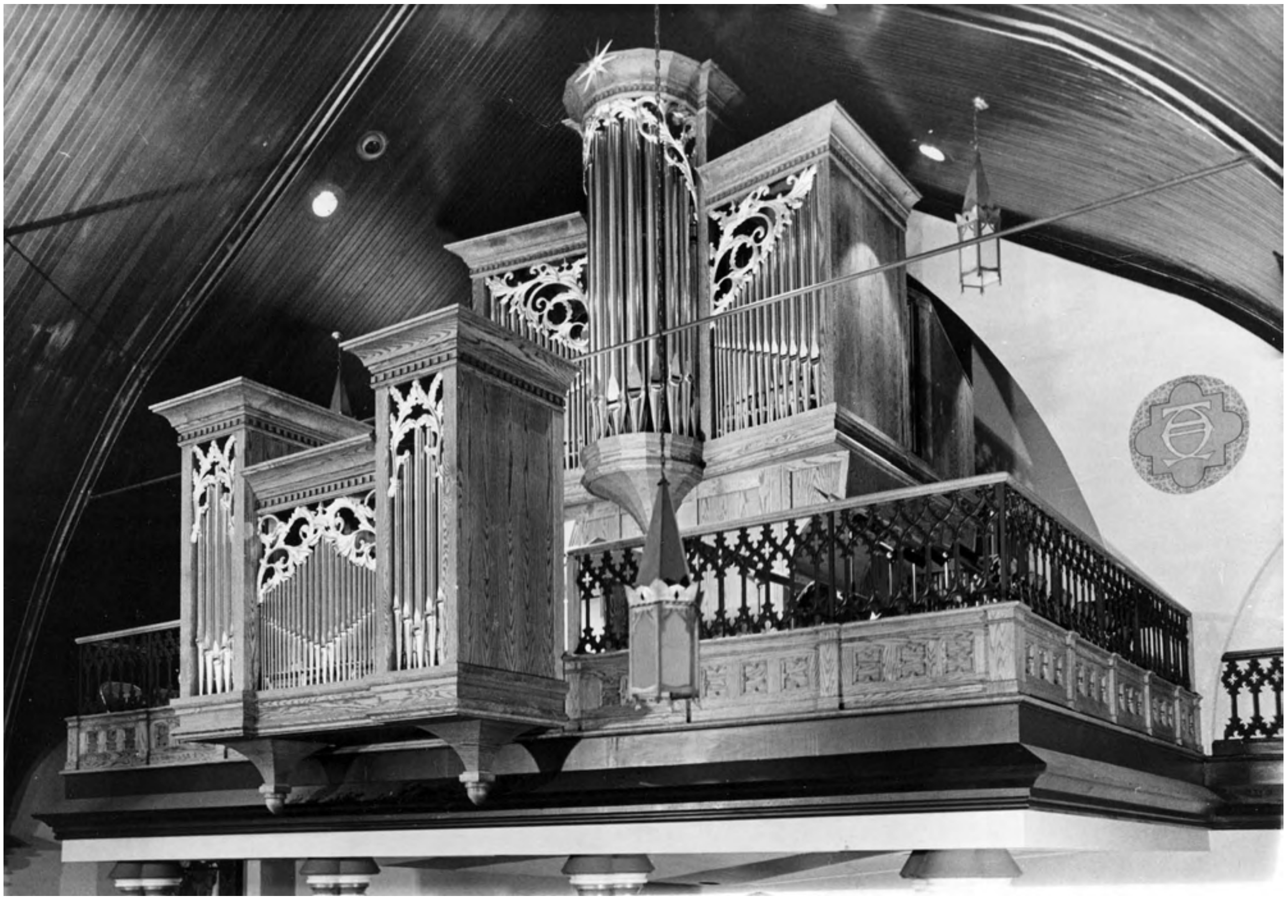

Fig. 11. Andover organ, op. 83a (3/39), Church of the Epiphany, Danville, Virginia (Photo by William Van Pelt).

Andover area, at first in Lawrence, then a permanent workshop in Methuen. Along with maintenance, he rebuilt a number of existing organs, giving them clearer and more brilliant ensembles. Also, new organs with electric action and modern tonal design were made.

In 1955, Charles B. Fisk, who had studied physics at Stanford University and subsequently worked for Walter Holtkamp, became a partner with Byers. During the early years, much work was performed on old New England tracker organs, and the emphasis of the company gradually turned in this direction. In 1956, their first new organ, using slider-chests and electric action, was installed in the Congregational Church of Williamstown, Massachusetts, followed the next year by a similar instrument for the Rice Institute in Houston, Texas.

In 1956, Robert J. Reich, a Yale graduate and former teacher, joined the company, followed in 1957 by Leo E. Constantineau, a graduate of the New England School of Art, cabinetmaker, and specialist in visual and mechanical design. By 1958, the company decided to build only tracker organs in the future and to specialize in tracker organ rebuilding and maintenance, soliciting this type of work throughout New England and adjacent states. The first new American tracker organ since the end of the tracker era was installed in 1959 in Redeemer Lutheran, Lawrence, Massachusetts.

In 1958, Fisk became sole owner of the Andover Organ Company. In 1960 he moved to Gloucester, Massachusetts, to build tracker organs under his own name. Constantineau and Reich remained in Methuen as president and treasurer/tonal director, respectively, of Andover. In 1962, Donald H. Olson, a graduate of St. Olaf College, joined the company, later becoming general manager and part owner. In 1964, Andover effected the world's first "retrackerization" of an electrified tracker organ at St. George's Primitive Methodist, Methuen, setting an example for future retrackerizations by Andover and others.

In 1979 the firm purchased an old mill building in the Arlington District of Lawrence, Massachusetts, where it remains today, employing twenty workers. Andover's average annual output is two new organs and three to four rebuilds or restorations. Since the 1950s, Andover has restored, renovated, or rebuilt several hundred old tracker organs, often with tonal improvements, and always with retention of mechanical action.

Some of the more significant organs of the company are: Mt. Hermon School, Northfield; Phillips Academy, Andover; Gordon-Conwell Theological Seminary, Wenham; St. Paul's Episcopal Cathedral, Boston; First Congregational, Rockport (all in Massachusetts); Lawrenceville (New Jersey) School; Lutheran Theological Seminary, Gettysburg, Pennsylvania; Meredith College, Raleigh, North Carolina; St. John's Episcopal, San Bernardino, California; Church of the Epiphany, Episcopal, Danville, Virginia; Westminster Presbyterian, Clinton, South Carolina; and First Presbyterian, Richmond, Virginia. Andover's most recent new organ (op. 112) was built for Saint Bartholomew's Episcopal, Yarmouth, Maine (2/18).

Robert J. Reich

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ANDREWS, ALVINZA (1800–1862)

American organbuilder. In 1834, Andrews began making Seraphines in Waterville, New York. By 1842, he was building pipe organs; a small instrument was erected that year in Zion Episcopal, Morris, New York. In August 1852, Andrews relocated his shop to Utica, a center of commerce in upstate New York with convenient access to transportation. Following his death in Utica on 8 October 1862, he was succeeded by his son, George Norton Andrews (b. Waterville, NY, 12 Oct 1832; d. Oakland, CA, 17 Sept 1904), who relocated the business to Oakland, California in January 1888.

In total, the Andrews firm built about two hundred instruments between ca. 1840 and l904. During the 1840s and '50s, it supplied clients in Boston and New York, in competition with Henry Erben and Thomas Appleton. His largest organ may have been the instrument built in 1855 for Utica's Westminster Presbyterian. Andrews's organs were influential and had a wide geographical distribution. A serious study of his work is awaited.

Stephen L. Pinel

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ANSELMI-TAMBURINI

See Tamburini

ANTEGNATI

Italian family of organbuilders, composers, and musicians active between the late fifteenth and mid-seventeenth centuries. The Antegnati organ firm was founded by Bartolomeo Antegnati (b. Brescia, ca. 1450; d. Bergamo, 1501), the son of Giovanni Antegnati, a lawyer who had established citizenship in Brescia with his father Lorenzo in 1436. Having set up a workshop in Lumezzane, Bartolomeo became the first organbuilder of the family, possibly learning the art of organ building from Bernardo d'Allemagna. An early work appears to be the reconstruction of the S. Maria Rotonda in Brescia (1481) by one "magistro Bartolomeo de Lumesani." He is best known for his organs at S. Pietro, Bergamo (1484), the Duomo in Milan (1489–91), S. Maria Maggiore, Bergamo (1496), and the cathedrals in Como and Mantua. In 1501 he found himself in Albino (near Bergamo), where he began negotiations for the construction of an organ for the Coronation of the Virgin Mary in Lodi, a task he abandoned in 1503. In addition to building organs, Bartolomeo was organist at Brescia Cathedral.

Of Bartolomeo's two sons, Giovanni Giacomo Antegnati (b. Brescia, ca. 1501; d. 1563) received the most praise for his work. His organs include those at S. Maria delle Grazie, Brescia (1533), the cathedrals in Milan (1552–59) and Parma (1556–59), and S. Maria della Passione (1558). He also restored the organs at the Vigevano Cathedral (1547) and Salò Cathedral (1548). Taking up residence in Milan in 1540, Giovanni Giacomo may have been the organist at the Duomo for a period of time. Benedetto Antegnati (b. 1535; d. 1608), son of Giovanni Gioacomo, built and restored a number of organs, including those at S. Alessandro, Brescia (1564), Duomo, Turin (1567), S. Maria della Steccata, Parma (1573), and the Parma Cathedral (1575).

Bartolomeo's other son, Giovanni Battista Antegnati (b. Brescia, ca. 1490; d. Lodi, ca. 1556), was known primarily as an organist, holding a position in the Chiesa dell'Incoronata, Lodi (1544–56); he was involved in the reconstruction of the organ in the Basilica del Santo, Padua. Giovanni Francesco Antegnati (fl. 1533–1585), probably the third of Bartolomeo's sons, was praised by Giovanni Maria Lanfranco (*Scintille di musica*,

1533) for his "extreme diligence in the construction of monochords, harpsichords, and clavichords." He also helped Giovanni Giacomo in the construction of the organ at Salò Cathedral (1548).

The most remarkable builder of the Antegnati family was Graziadio Antegnati (b. 1525; d. after 1590), son of Giovanni Batista. He built organs at S. Maria Maggiore, Bergamo (1564–66), S. Spirito, Bergamo (1566–67), S. Barbara, Mantua (1565), Asola Cathedral (1573–1575), and the Crema Cathedral (1586). His only extant organ, however, is at S. Giuseppe, Brescia (1581).

Costanzo Antegnati (b. Brescia, 9 Dec 1549; d. Nov 1624), son of Graziadio, is the best-known member of the family. He collaborated with his father (from 1570) before taking a post as organist at Brescia Cathedral, a position he held until 1604. His organs include those at S. Giorgio, Bagolino (1590), the Madonna della Steccata, Parma (1593), S. Maria Maggiore, Bergamo (1593–94), and S. Giorgio Maggiore, Venice (1612). His fame rests primarily on his *L'arte organica* (Venice, 1608), a treatise containing a list of 144 organs built by the family, rules in tuning organs, harpsichords, and monochords (basically advocating meantone temperament), and suggestions on organ registration. In addition to twelve ricercars (published as *L'Antegnata* (1608) together with *L'arte organica*), Costanzo also composed a number of madrigals, masses, and motets. Costanzo's son, Giovanni Francesco Antegnati (b. 1587), serves as an "interlocutor" in *L'arte organica.*

The last organ-building member of the Antegnati family was Graziadio Antegnati (b. Brescia, 1609; d. 1656). In 1636 he was the *conservatore* of the organ at S. Marco, Venice; he later became organist at the Padua Cathedral (where he maintained the organ, 1644–45). He also worked on instruments at S. Giorgio Maggiore, Venice, and Brescia, S. Carlo, attributed (1636; 1/12; rest. Maccarinelli, 1958).

The specifications of the Antegnati organ were uniform in style: a single manual, a pull-down pedal, an open flue chorus (Principale 8'), a few Flutes of wider scale, and a single ripieno stop, incorporating an Ottava (4'), Quintadecima (2'), and, depending on the size of the instrument, Decimanona (1-1/3'), Vigesimaseconda (1'), Vigesimasesta (2/3'), Vigesimanona (1/2'), and Trigesimaterza (1/3'). Antegnati avoided reed stops and (unlike other Italian builders) double ranks for the ripieno and the Principale.

THOMAS CIMARUSTI

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APPLETON, THOMAS (1785–1872)

American organbuilder. Born in Boston on 26 December 1785, the son of a carpenter, Appleton was apprenticed to a cabinetmaker, but became associated with William M. GOODRICH in 1807 along with the piano builder Alpheus Babcock, who later shared their workshop. The partners operated a workshop at the Franklin Musical Warehouse. A small chamber organ, now in the Congregational Church of Phillipston, Massachusetts, has "Goodrich & Appleton" inscribed on its nameboard, and appears to have been built in 1812, the year Appleton married Goodrich's sister.

When the Franklin establishment closed, Appleton opened a workshop in Boston late in 1820. He built an organ for the First Church in Roxbury, Massachusetts, assisted by Ebenezer Goodrich, who, over the span of two or three years, occasionally worked for him. Others who were associated with him in the 1820s were Henry CORRIE and cabinetmaker James Cogswell, who made many of Appleton's unusually handsome organ cases. During the 1830s Appleton was unquestionably the leading organbuilder in Boston, securing contracts for prestigious churches such as Boston, Bowdoin St. (1831, associated with Lowell Mason) and the Hartford, Connecticut, Centre Church (1835), as well as Boston's Academy of Music (1836). By the 1840s his work could be found along the eastern seaboard from South Carolina to Maine; one of his largest organs was built in 1846 for the Church of the Pilgrims in Brooklyn, New York.

Among the men trained in his workshop were WILLIAM B. D. SIMMONS, Thomas McIntyre, and Thomas D. Warren, who was Appleton's partner from 1847 until 1850, when Appleton moved his workshop to Reading, Massachusetts. In 1856 Horatio Davis was, for a brief time, Appleton's partner. Although highly regarded, Appleton faced increasingly serious competition from younger builders such as the Hooks; fewer organs appear to have been built in the Reading shop. His last instrument, built in 1867 for Boston's Baldwin Baptist, was among the largest of his more than 100 organs. He died in Reading on 11 July 1872. Two of his organs are now in the Metropolitan Museum of Art, New York, and the Smithsonian Institution, Washington, D.C.

BARBARA OWEN

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AQUINCUM ORGANBUILDER COMPANY

Hungarian organ-building firm. Founded in 1894 in Budapest by RIEGER, the company began as a branch to the main workshop in Jägerndorf, Austria (now Krnov, Czech Republic). The Budapest shop soon became an independent firm and, in the first half of the twentieth century, produced well over a thousand instruments for locations in Hungary and throughout Europe. During World War II the company sustained considerable physical damage and during the difficult postwar era the nationalized company struggled to continue its maintenance and building of church organs. After the proprietors of the former Rieger branch were expelled from Hungary in 1974, Gábor Kovács took over as director of the Budapest branch. In 1976 the firm returned to the production of tracker organs, signaled by the exhibition of two instruments at the Budapest International Fair. Changing its name to Aquincum, the firm developed markets in Germany, Hungary, and Iceland. In 1990 the management obtained ownership of Aquincum as a private enterprise under the direction of Kovács.

Aquincum has based its tracker organs on the Dutch classical suspended action organ, although elements of Romantic voicing are mixed into the Baroque sound. New instruments in Hungary include: Debrecen, Reformed (3/57); Pannonhalma, Benedictine Abbey (1985; 3/41); Nagykőros, Reformed Church (1997; 3/46); Tihany, Benedictine Abbey (2/24); Szombathely (3/54); Piliscsaba, St. Peter Catholic University (3/37); Hévís, Holy Spirit (3/36); and Zirc, Cistercian Abbey (3/44). Among the firm's restorations was the reconstruction and enlargement of a 1902 Rieger organ at the Ferenciek Tere Templon in Budapest, built in 1743. The original case was adapted to hold four manuals and the Pedal; all work was done on location. The wind pressure is 75 to 80 mm; tracker key action is used, but the stops and combination stops are electric.

DOUGLAS E. BUSH
RICHARD KASSEL

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ARGILLIÈRES, D'

SEE D'ARGILLIÈRES (DARGILLIÈRES, DESARGILLIÈRES)

ARNAULT (ARNAUT) DE ZWOLLE, HENRI (D. 1466)

Doctor of medicine, astrologer, astronomer, and theorist. It is generally accepted that Arnault was born in Zwolle (Netherlands), although some have suggested that he may have been from Zuuolis (Bohemia). Arnault de Zwolle is best known for his treatise on musical instruments (MS Bibl. Nat. Paris, lat. 7295). This treatise is usually dated around 1440, when Arnault was in the service of Philip the Good, Duke of Burgundy. In about 1455 he entered the service of Charles VII of France, and later of Louis IX of France. He died of the plague in Paris.

Arnault's untitled treatise is very important since it is the oldest known technical description of European musical instruments. He provides diagrams on the construction of the lute, the harpsichord, the clavichord, the *dulce melos* (keyed dulcimer), and the organ. He gives an empirical description of organ pipes, describes two sorts of PORTATIVE chests, refers to REED as well as PEDAL pipes, and provides details on the *tergali positivo* (CHAIR ORGAN, or POSITIVE).

FERDINAND J. DE HEN

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ARTICULATION

SEE VOICING

ASIA

The countries and regions of the largest continent have highly developed cultures that predate Western cultures by centuries. China is the legendary birthplace of the *shêng*, a free-reed MOUTH ORGAN, five millennia ago, although the instrument's first known mention is around 1000 BCE. The early cultural exchanges came mostly from the East, rather than the West, often accompanied by invasion. The direction of influence began to shift in the seventeenth century, fueled by missionary fervor, then colonization and/or commercial interests. Occidental musical culture followed, especially in areas controlled or heavily influenced by the British Empire. Organs were imported to China; a 1921 inventory revealed pipe organs in Shanghai (tracker instruments by WALKER, pneumatic instruments by HARRISON AND HARRISON or Spurden-Rutt; also the ODELL firm from the U. S.), and Tianjin (Spurden-Rutt). In Hong Kong, Blackett and Howden or Walker made most of the instruments. There was a 1905 HENRY WILLIS II instrument in Bangkok and a Brindley and Foster in Ceylon (now Sri Lanka). In French Indochina, Notre Dame Cathedral in Saigon (now Ho Chi Minh City) had an Aristide CAVAILLÉ-COLL; the church survived the long civil war, but the organ's present status is unclear. A lesser-known company, Gebrüder Wellershaus of Saarn/Mühlheim, put at least one instrument in Java (now part of Indonesia) in the early twentieth century.

While the Philippines belonged to Spain (sixteenth through nineteenth centuries), the colony imported organs that were assembled and maintained by Spanish (and perhaps Mexican) builders. A remarkable organ was built by a Spanish missionary, Fr. Diego Cera, who had built organs in Manila. He began building an organ in nearby Las Piñas in 1816 using only bamboo wood, abundant in the region, for the pipes. The organ was first heard in 1821; metal horizontal trumpets were added by 1824. This one-manual organ, with nine divided stops and a one-octave Pedal stop, endured floods, earthquakes, and other ravages of time, and was unplayable by the end of the century. The KLAIS firm finally restored the instrument at its Bonn workshop (retaining its tracker action) and reinstalled it to great acclaim in Las Piñas in 1975. Since World War II, new (mostly German) instruments have been imported and assembled by local Filipino builders; while most of these are in Manila, the Mindanao city of Ozamiz has a Wagenback and LAUKHUFF in the Cathedral of the Immaculate Conception (1967; 2/30). There are signs of a local organ-building industry: in 1994, Cealwyn Tagle and Edgar Montiano completed the first Filipino-made pipe organ, located in the Diego Cera Auditorium adjoining the Las Piñas parish church.

The organ became far more prevalent in Asia after World War II, especially in Japan, which had maintained an ambivalent attitude toward Western culture for centuries and accepted its trappings with considerable reluctance. One rare exception was Torakusu Yamaha (1851–1916), who founded the Yamaha Reed Organ Manufacturing Company in 1887 and built his first reed organ in 1900. Japan came out of Allied occupation with a thirst for things modern (Western technology) and classical (Western music). As Western music received increasing attention in academia, concert performance, and as part of the small but significant influx of Western religions, pipe organs were commissioned from foreign builders in unprecedented numbers. The most active firms have been Klais, SCHUKE, Rudolf von BECKERATH, CASAVANT FRÈRES, OBERLINGER, and Werner Bosch Orgelbau (founded 1945, located in Niestetal/Hesse), which has built over ninety instruments for Japan. Other German firms include Paul OTT, RIEGER, Jehmlich, and Speith-Orgelbau, Rietberg (Nagasaki, St. Pius X, 2/21). The Danish firm MARCUSSEN & SON received attention when it rebuilt its 1992 organ for Konan Women's University in Kobe soon after the 1995 earthquake there. British builders returned to build instruments throughout Japan, including MANDER, Harrison and Harrison, and Simon Platt. American companies such as TAYLOR AND BOODY (Yokohama, Ferris Girls' School, 1989, 3/45, tracker), John BROMBAUGH, CHARLES B. FISK, and Hoenig (Ft. Madison, IA) brought their American neoclassical approach to the country. Having acquired the necessary skills, Japanese firms began constructing organs, including the neoclassicist builder Hiroshi TSUJI (Gifu/Kurokawa, Museum of Fine Arts, 1984; 1/9, after 1775 Tronci organ), Tokugoro Ohbayashi (Shirioishi/Tokyo, "The Cube" Concert Hall, 1997, 5/115, "symphonic" organ with MIDI compatibility), and Tetsuo Kusakari (Kiyose/Tokyo, Migiwa Church, 1997, 2/8, tracker). A physicist, Toshiyuki Mitsuhashi, built a well-received instrument for a church in Tsukuba. The federal government and two organizations, the Japan Organ Society and Japan Association of Organists, have been crucial to the support of postwar organ building, not without some infighting. The founding of the Japan Reed Organ Club in 1996 indicated the local popularity of instruments once popular in the West.

South Korea, which has experienced economic growth similar to Japan's, has instruments installed in several cities; the most active builders include Schuke (Seoul, Sejong Cultural Center, 1976, 6/121, largest Asia), Rieger/Glatter-Götz (Seoul, Torch Center for World Missions, 1997, 4/85) Klais (Seoul, Presbyterian, 3/57), RUFFATTI (Seoul, Dae Bang Dong Church, 1998, 2/17), Oberlinger (Taejon, Hyechon University, 1999, 3/44), Platt (Seoul, Chung Lim-Dong Hall, 1995, 3/36), Bosch (Seoul, Myeong Dong Cathedral, ca. 1985, 3/35) Harrison and Harrison (Seoul, Anglican Cathedral, 1985, 2/20), Speith (Taejon, Baptist, 3/45), Vleugels (Seoul, First Methodist Church, 2/21), Rieger-Kloss, and WICKS. The Klais firm installed a well-publicized instrument at the Esplanade at the Singapore Arts Center (2003, 3/63), as well as organs in Hong Kong (Chinese University), Malaysia, and Taiwan. The most symbolic installation of all may be Oberlinger's 1999 instrument at Beijing's China National Radio (3/50).

In India, Indochina, Indonesia, and Sri Lanka, there are few traces of colonial pipe organ culture; in India, particularly, the harmonium became the preferred keyboard instrument for light classical music and *filmi* (soundtracks). More important, however, was the introduction of the electronic organ. First imported from the United States and Europe in great numbers after World War II, Asian builders were soon equaling and then outpacing the imports with products of good or better quality as their models. Japan started the trend, followed soon by South Korea, Taiwan, and mainland China. Other countries (Indonesia, Philippines) were active in the assembly, if not the manufacture, of electronic organs. The expense and complexity of pipe organ building has pushed smaller churches toward electronic instruments; but in Japan and wherever else Western music (especially that of Johann Sebastian Bach) has taken root, the pipe organ remains a sought-after instrument, although remaining by and large a product of foreign builders.

RICHARD KASSEL

AUBERTIN, BERNARD (B. 1952)

French organbuilder. Born in Boulay, Metz, Lorraine on 25 August 1952, Aubertin established the Manufacture d'Orgues Franc-Comtoise in Courtefontaine in 1978. In its factory, a twelfth-century former Augustinian priory in the Jura Mountains near Dôle and Besançon, the Aubertin firm has produced about twenty historically oriented instruments ranging to as many as forty-seven registers, and a similar number of restorations. Metal for lead pipes and for tin pipes in French style is hammered on a motorized re-creation of François BÉDOS DE CELLES's metal-hammering machine; key action is suspended in historic fashion; temperaments are unequal (normally Kirnberger III, sometimes meantone); wind supply is from wedge bellows, sometimes equipped for optional manual pumping. In the fashion of Arp SCHNITGER and other historic builders, Aubertin designs his cases in geometric proportions, according to the church or hall in which the instrument is to be installed. Influenced by a long family tradition of woodwork, his wood carvings are lavish and frequently incorporate local symbols. An instrument in a twelfth-century church at Viry-Châtillon near Paris includes the town's coat of arms, which commemorates its identity as Paris's earliest airfield; an instrument for a Vichy church built under Napoleon III features stylized Napoleonic eagles. In addition to the firm's instruments in Europe, a 1992 instrument of forty-five registers was installed in a concert hall in Shirane-Sho (Japan), near Mount Fuji.

JOHN HAMILTON

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AUDSLEY, GEORGE A(SHDOWN) (1838–1925)

British-born architect, decorative arts scholar, and organ designer. Audsley was born in Elgin, Scotland, on 6 September 1938. His elder brother, William James Audsley (1833–1907), had established an architectural practice in Liverpool by the late 1850s. George apprenticed at another Liverpool architectural firm before joining his brother around 1860, and began to lecture on elements of Victorian interior design, then heavily influenced by the pre-Raphaelite movement. George (usually in collaboration with his brother) published books on Christian symbolism, illumination and missal painting, use of color, floral decoration, ornamentation, design of smaller residences, Japanese plastic arts, and chromolithography. George and William were elected fellows of the Royal Institute of British Architects (1876). In the mid-1880s, William emigrated to the United States and set up offices in New York; he was followed by George (ca. 1892), who collaborated with him in building churches in the metropolitan area. George continued the firm after William's death, but returned to England in 1910 to publish several books on decoration, color, Japanese art, and British cathedrals, mostly with his son Berthold Audsley (b. 1873). The two returned to the United States in 1914; George continued to consult and write until his death in Bloomfield, New Jersey, on 21 June 1925.

George A. Audsley's serious interest in the organ began when he heard a recital by William T. Best on the Willis organ (1855) at St. George's Hall, Liverpool, in 1856. The combination of the organ's power and the acoustics of the vaulted hall in which it was erected made for an impressive aural display. Audsley began studying organs in Europe (later in the United States), publishing a series of articles, "Practical Hints for Amateur Organ-Builders," in 1876. One of these referred to the chamber organ he had built for himself (1865–72; 2/17; enl.; 2/20; second manual enclosed, first manual partly enclosed). During this time Audsley began to offer professional organ consulting services. At first he was involved with installations in his own buildings, as in Liverpool, St. Margaret, Anfeld (1870), where a Hill and Son organ was installed in 1873 (mech., hydraulic winding; reb. Rushworth and Dreaper, 1922; 3/41, tub.; electric blower; destr. 1961). He apparently designed other British instruments in the 1870s and '80s, although evidence remains vague.

A significant breakthrough for Audsley involved his case design for the Hilborne L. Roosevelt organ at Great Barrington, Massachusetts, First Congregation (1883; 3/60; extant). This success emboldened Audsley further; beginning in 1886, he began to publish articles on stop nomenclature and, more significantly, his three categories of organ (chamber, church, and concert hall) and their ideal characteristics (for a complete list of writings, see Fox). He attacked "prejudiced groups of professional organists," suggesting that organ-building insiders could never free themselves from familiar paths, even those "working in all good faith." His views brought the criticism of "insiders" like Carlton C. MICHELL, who preferred "the simplication system [to] the old one of multiplication," and that as an amateur Audsley would be unable to persuade buyers "to pay the increased cost which his ideas involve, beside [his] commission . . . when they can go direct to the professional experts and manufacturers and save both charges with better results" (1889). Although Audsley could hold his own in the verbal warfare over his ideas that continued to the end of his active career, he felt himself to be "rejected by the builders."

Audsley was selected to design the instrument for the Louisiana Purchase Exhibition (St. Louis, 1904), to be built by the Los Angeles Art Organ Company, successor to Murray M. HARRIS. He designed the instrument (5/140) on the Romantic principles of Aristide CAVAILLÉ-COLL and E. F. WALCKER. Having distinguished between church and concert organs, Audsley placed an Orchestral division (rather than a Choir) that, in larger organs, would divide into separate woodwind and brass manuals. The Ancillary Organ or floating division was most often dedicated to the strings, which could be coupled with woodwind, brass, or both. The organ was destined for Kansas City after the Exposition, but instead went into storage until 1909, when John Wanamaker purchased the instrument for his new department store in Philadelphia. It underwent a number of enlargements between 1914–27 (now 6/461), and remains a recital instrument at what is now Lord and Taylor.

While working to create the Exposition instrument, Audsley was seeing his book, *The Art of Organ-Building* (1905), through the press. This thorough and opinionated survey of organ case and tonal design established Audsley's reputation as a leading authority on organ design and construction, although he had based much of his work on F. E. Robertson's *Practical Treatise on Organ Building* (1897). The book is especially noteworthy for finely executed drawings of organ mechanisms and a variety of pipes. Audsley followed this work with *The Organ of the Twentieth Century* (1919) and *Organ Stops and Their Artistic Registration* (1921), both based on the 1905 work; *The Temple of Tone* was left unfinished, and was published posthumously (1925).

Michell and others proved correct regarding the high costs of Audsley's designs; as he was not a builder himself, he needed to convince both builder and client to accept his ideas. He did succeed in this through his association with Philipp Wirsching (1858–1926), a German immigrant who worked for FARRAND AND VOTEY as well as W. W. KIMBALL before setting up his own firm (Salem, Ohio, 1898–1917). Audsley-Wirsching organs were erected at the Yonkers, New York, E. C. Clark residence, which Audsley built (1907; 1/22?; destr.); Philadelphia, St. Louis (Ludwig; 1907; dism.); Hoboken, New Jersey, Our Lady of Grace (1908; 3/52; later reb.; extant); and New York, E. Mills residence (1909; dism.).

Around 1918, he established "Brook and Audsley, organ architects" with A. S. Brook, an organist who had helped erect the Exposition organ. The pamphlet announcing the firm including the following: "G. A. Audsley, the author of the standard work on the art of organ-construction, is a church architect of reputation, and was the *first* expert in the history of organ-building to put two swell boxes or expressive divisions in an organ, and to point the way to the development of the organ as an expressive instrument throughout all its tonal divisions" [emphasis in the original]. Here Audsley expresses his assertion of the centrality of expressivity (dynamic change) and flexible sonority, an obsession that had its origins at the 1856 Liverpool recital. Audsley was clearly taking an architectural (audience's) view of organ tone, rather than a builder's or performer's.

No work is directly attributable to Brook and Audsley; however, two more Audsley-designed instruments were built: a theater organ at Upper Montclair, New Jersey, Bellevue Theater (Austin, 1921–22; 3/20), the kind of extension organ he would have opposed on principle earlier (to Whitinsville, Massachusetts, 1943; reb. 1947); and Hamilton, Ohio, First Methodist Episcopal (Moller, 1925; 3/64; repl. Casavant, 1969).

Audsley's broad perspective on organ building covered everything from the designs on the drawstops to room acoustics and their effect on tonal design. He was the Ernest M. SKINNER of his era—a Romantic orchestral organ idealist who fought with heat for his views when required. The difference between them was that while Skinner was a fully trained builder whose battles at the ÆOLIAN-SKINNER ORGAN COMPANY over the fine points of design could be intense, Audsley would complain of a font change in a published article of his in the *American Organist*. He was not a scientist of sound, either; his theories of acoustics were patently incorrect. Yet this "amateur" managed to realize his dream as an "organ architect" in a glorious fashion; his most significant legacy, the Wanamaker organ, remains a larger-than-life realization of that dream, however altered over the years. Finally, *The Art of Organ-building*, flaws notwithstanding, may still be the most significant tome on the subject in English.

RICHARD KASSEL

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AUSTIN, JOHN T(URNELL) (1869–1948)

English-born builder and inventor, active in America. Austin was born in Podington, a village north of London; the eldest of three boys, he was one of five children of Jonathan Austin, a gentleman farmer and amateur organbuilder, credited with at least three organs; his sons had their first organ-building experience assisting their father. Well-educated, John attended a boarding school in London, where he was a choir boy. He later attended a preparatory school in Wellingboro, and took lessons from an organist in Irchester, where he had lived since 1877.

In 1889 Austin traveled to America, and soon found work with FARRAND AND VOTEY in Detroit. Discovering that the WINDCHEST mechanism of Farrand and Votey organs was relatively inaccessible and difficult to service, he began searching for a more practical approach to chest construction. The result was an invention that became an important feature of Austin organs: the Universal Air Chest, a windchest that combined the functions of traditional chests, wind conductors, and reservoirs, permitting a technician to work on the interior of the chest even while the organ was turned on and being played.

Failing to interest Farrand and Votey in his invention, Austin went to work for the Clough and Warren Organ Company of Detroit in 1893. Between June 1893 and February 1899 this firm built twenty-eight organs using the Austin Universal Air Chest design. There were other important events in John Austin's life. In 1893 his brother, Basil G. Austin (1874–1958), arrived from England. He, too, worked first at Farrand and Votey, then at Clough and Warren. In 1894 John Austin became an American citizen.

The Clough and Warren factory burned down on 2 February 1899. Soon after, John Austin, Robert Pier Elliot (1871–1941), and two business partners formed the AUSTIN ORGAN COMPANY. The firm was located for a brief time in Boston, but by the fall of 1899 it had moved to a permanent home in Hartford, Connecticut. Basil, who had gone to the Yukon Territory to look for gold in February 1898, returned in July 1900 to join his brother in the new company. Another brother, Harry Austin (1870–1931), and his family moved to Hartford from England in 1920. Both he and his son Frederic B. Austin (1903–1990) worked in the Austin factory. In 1936 the Austin Organ Company closed, and John and Basil Austin retired from business. A new company, Austin Organs, Inc., was then formed under the leadership of Frederic B. Austin.

John Austin's employees viewed him as generous and considerate; in the organ world he was highly respected as a man of exceptional ability and integrity. His organ-related innovations focused on reliable performance and ease of maintenance. In addition to the Universal Air Chest, he invented new designs for console components, swell shutter action, chest action, centrifugal blowers, and an automatic player mechanism. In all, he is credited with fifty patents. His brother Basil also contributed inventions used in Austin organs, and assisted with the development of some of John's inventions. These inventions were a major factor in distinguishing the firm's instruments and even its Hartford factory from those of competitors. The tools he devised for the manufacture of organ parts made the Austin shop a model of efficiency; a machine that operates ten saws and seven drills is still in use.

ORPHA OCHSE

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AUSTIN ORGANS, INC.

American organ-building firm. The company was founded in 1899 as the Austin Organ Company by John T. AUSTIN and a small group of business associates. Initially located in Boston, the company moved to a permanent home in Hartford, Connecticut, before the end of the year. In 1900 John Austin's brother, Basil G. Austin (1874–1958) joined the firm; together, the Austin brothers developed one of America's most successful organ companies.

John and Basil Austin retired from organ building in 1936, and the original company closed. It was succeeded in 1937 by a new company, Austin Organs, Inc., under the leadership of Frederic B. Austin (1903–1990), a nephew of the founders. He successfully guided the firm through the difficult years of the late 1930s and World War II and into a dynamic postwar boom in organ building. When he retired as president in 1973 he was succeeded by his son, Donald B. Austin (1933–2004), president and chairman of the board of directors until 1998. He was succeeded by his daughter, Kimberlee J. Austin (b. 1960), daughter of Donald B. Austin. The firm closed in early 2005.

From the beginning, the company's reputation for integrity, high-quality workmanship, and reliable instruments led to significant contracts for large instruments in prominent locations. Two well-known examples of Austin municipal organs still in use are the Kotzschmar Organ in Merrill Auditorium, Portland, Maine (1912), and the Spreckels Organ in Balboa Park, San Diego (1914). Although the greater number of Austin organs have been built for churches, the firm has also produced instruments for venues such as theaters, lodges, residences, department stores, schools, radio stations, and municipal auditoriums. By the end of the twentieth century the company list of instruments had reached opus number 2781. Among notable Austin instruments of recent years are organs in the National Shrine of Our Lady of Czestochowa and the Episcopal Church of Bethesda-by-the-Sea, Palm Beach, Florida. St. John's Episcopal Church, West Hartford, Connecticut, was given an instrument in memory of John T. Austin (1949–50). This organ was seriously damaged by a fire in 1992, and replaced by another Austin organ four years later; several chests and twenty-four ranks of pipes from the original Memorial Organ were incorporated.

A growing appreciation for American organs built between 1910 and 1950 has led Austin Organs to play an increasingly important role in restoring instruments, among them Austin organs (e.g., the 1926 organ in Irvine Auditorium, University of Pennsylvania, Philadelphia), but organs of other builders as well (Grand Rapids, MI, Fountain Street Church, 1924 Skinner organ; op. 2782, 2004; 5/172).

In tonal style, Austin organs have characteristically maintained a middle-of-the-road position, changing with moderation in the direction of current style trends. John, Basil, and Frederic Austin were all English-born, and tended to prefer English models. James B. Jamison joined the Austin firm in 1933. While he was not officially appointed tonal director, he influenced Austin tonal style toward greater clarity in ensembles from 1933 to 1949. His tonal models, too, were generally English, modified by some characteristics of American and French styles. For over fifty years, Austin tonal directors were from England: Richard Piper (1949–78), David A. J. Broome (1978–98), and Bruce Q. Buchanan (1998–2002). The last tonal director was Daniel R. Kingman.

ORPHA OCHSE

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AUSTIN UNIVERSAL WINDCHEST

SEE ACTION; WINDCHEST

AUSTRALIA

Shortly after the first English settlement of Australia in 1788, a number of British emigrants brought with them some small barrel or chamber organs. It was not until the 1820s, however, that the first commissioned church organs arrived, built by the London firm of John Gray for churches in Sydney and Hobart. In the following two decades, a number of mainly small instruments arrived from Britain; a notable exception, the 1840 Henry Bevington organ for St. Mary's Cathedral, Sydney, had a 32' Pedal stop and an A. W. N. Pugin case (destr. by fire). By the 1850s, large numbers of British organs were shipped to Australia in the wake of high British emigration and the wealth that accrued as a result of the gold rushes.

There is evidence that William Hance was building an organ in Hobart, Tasmania (then called Van Diemen's Land) as early as 1832, but it in unclear whether it was successfully completed. The earliest documented attempt at local organ building was made at Sydney in 1840 when Johnson and Kinloch completed a new two-manual organ for St. Matthew's, Windsor; these builders later individually built instruments for clients in New South Wales. Through the 1840s, there were isolated examples of local organ building in Adelaide (by Samuel Marshall) and Melbourne (by Peter Hurlstone). During the 1850s in Melbourne, James Moyle and

Henry Smith were engaged in organ building, while in Tasmania Jesse Biggs was involved in tuning, maintenance, and the installation of imported organs. In the Barossa Valley region of South Australia, several German expatriates built German-style small instruments. These included Carl Krüger (1802–1871) and Daniel Heinrich Lemke (ca. 1832–1897). Krüger had come from Cottbus in 1848, while Lemke had emigrated from Grabowa Hauland, Posen in 1855. Their instruments were mainly small positives, considered to show the influence of Gottfried SILBERMANN. Johann W. Wolff later built organs in South Australia, while Ernst Ladegast (1853–1937), son of noted German organbuilder Friedrich LADEGAST, emigrated in 1883 to Sydney and worked there for several firms.

From the 1860s on, the indigenous organ-building industry gained momentum, especially in Victoria, where a tariff gave protection to local builders; elsewhere in Australia the industry was slow to develop. George FINCHAM (1828–1910) worked for London organbuilders Bevington and J. C. BISHOP before emigrating to Melbourne in 1852. Opening a factory in the suburb of Richmond, his first instrument was completed in 1862; the firm prospered and, by the end of the century, had built almost 150 new organs for churches and public halls in four Australian states and New Zealand. Its magnum opus was the grand organ for the 1880 Melbourne Exhibition with four manuals, seventy speaking stops, 4,726 pipes, Barker lever action, and a 32′ facade. Initially adopting mechanical action, the firm employed a new system of tubular-pneumatic action from the late 1880s. Fincham organs were characterized by spotted metal pipework, low wind pressures, generally complete choruses, and multitowered cases. During the boom decade of the 1880s, the firm built than fifty-seven instruments; only twenty-six were built in the 1890s, owing to that decade's depression. Fincham and Hobday established in Adelaide in 1881, building eleven organs there; the business was taken over by Josiah E. DODD in 1894. Meanwhile, in Victoria, Fincham received competition from Alfred FULLER and William Anderson in the 1880s and 1890s. In Sydney, C. J. Jackson and William DAVIDSON were prominent as organbuilders from the end of the 1860s and Charles RICHARDSON (son of a prominent English builder) from the 1880s onward. Most of their instruments were smaller instruments, largely with mechanical actions.

By the end of the nineteenth century, Australia possessed some of the finest contemporary examples of the organbuilder's craft anywhere in the world. All of the illustrious English organbuilders of the period were represented by instruments there, including J. W. WALKER and Sons (fifty-four instruments) and HILL AND SON (thirty-four instruments), together with many regional builders from Birmingham, Bristol, Huddersfield, Hull, and Manchester. These instruments largely went to New South Wales in the absence of a strong local organ-building industry; many survive unscathed and are now of international significance. Hill and Son built the town hall organs at Adelaide, Melbourne, and Sydney, the latter the largest in the world at the time. Major church organs included the Hill instruments at St. Andrew's Cathedral, Sydney and SS Peter and Paul's Cathedral, Goulburn, the T. C. LEWIS at St. Paul's Cathedral, Melbourne, and the Forster and Andrews at St. Saviour's Cathedral, Goulburn. A number of organs arrived from continental Europe, from such firms as MERKLIN-Schütze, E. F. WALCKER, R. A. Randebrock (Paderborn, Germany), and Théodore Puget (Toulouse). In the early twentieth century, exports continued, including important instruments by Hill and Son, NORMAN AND BEARD, and Bishop and Son, culminating in the Hill, Norman and Beard organ for Melbourne Town Hall (1926–29; 4/108) and the Willis and Sons rebuilding of the Brisbane City Hall organ (1927–29). From around 1917, America's WURLITZER firm began to export theater organs to all of the Australian states, some as large as four manuals and more than twenty ranks; a few ÆOLIAN COMPANY player organs were imported for private homes.

A number of new names entered the organ-building scene in New South Wales and Victoria early in the twentieth century, including G. C. Griffin, C. W. Leggo, W. L. Roberts, and F. Taylor; all built instruments of symphonic design, most with tubular-pneumatic actions. The most important Australian builder of symphonic organs was Adelaide's Josiah E. Dodd, who forged a progressive organ-building style popular with clients in five Australian states and New Zealand. Later, the firm of Hill, NORMAN AND BEARD, AUSTRALIA opened a factory in Melbourne in 1927, the firm completing more than eight hundred contracts until its closure in 1974. The firm was the first in Australia to adopt electro-pneumatic action as its standard, many of which were built upon the extension principle.

While the interwar Depression saw fewer new organs built, the postwar period, particularly in the 1950s and 1960s, resulted in an organ-building boom, with many firms working to maximum capacity, building instruments with electric actions. These included Hill, Norman and Beard; Fincham and Sons; and Laurie Pipe Organs (all in Melbourne); J. E. Dodd and Sons, and Gunstar Organ Works (Adelaide; amalgamated 1942); and WHITEHOUSE Brothers (Brisbane). However, with a growing interest in the classical organ and the belated arrival of the ORGAN REFORM MOVEMENT in the 1960s, firms began building mechanical action instruments. Ronald W. SHARP (b. 1929) was the first to build modern tracker instruments in Australia, culminating with the largest mechanical action instrument in the world, at the Sydney Opera House (1979). The Sydney builder Roger H. POGSON (b. 1932) followed soon afterward; like Sharp, his instruments exhibit an original approach to design and solidity of construction. Later, Knud SMENGE (b. 1937) began building organs in Melbourne in the early 1980s after working in Denmark with MARCUSSEN & SON and Bruno Christensen and Son. His more than forty new instruments have a strong, articulate sound and outstanding craftsmanship.

In the late 1950s, the import of organs resumed with the arrival of Australia's first modern mechanical action instruments from E. F. Walcker; at the same time, J. W. Walker and Sons carried out considerable work in Australia. The first significant European export of the period was the large Rudolf von BECKERATH instrument (1972) for the Great Hall of the University of Sydney. Other important concert instruments included the RIEGER organ for the Festival Theatre, Adelaide (1979); the CASAVANT FRÈRES organ for Elder Hall, University of Adelaide (1979); the Jürgen AHREND organ for Robert Blackwood Hall, Monash University, Melbourne (1980); the Casavant organ for the Melbourne Concert Hall (1982); the KLAIS organ for the Brisbane Performing Arts Centre (1987); and the Walker organ for the Adelaide Town Hall (1990). Notable church organs of the past decade include the Kenneth Jones organ at Trinity College Chapel, University of Melbourne (1998), the Rieger organ at The Scots' Church, Melbourne (1999), the Casavant organ at St. Francis's, Melbourne (2000), and the Fernand LÉTOURNEAU organ at St. Mary's Cathedral, Sydney (2000). With the Australian dollar remaining uncompetitive internationally, it is unlikely that major imports will continue on the scale of the previous two decades.

The conservation of historic organs in Australia has been supported and promoted by the ORGAN HISTORICAL TRUST OF AUSTRALIA (founded 1977); government funding, particularly in New South Wales and to a lesser extent in Victoria, has greatly assisted careful restoration of significant instruments. Numerous firms have carried out restoration and rebuilding work. Pogson restored the Sydney Town Hall organ (1972–82), considered the most extensive of its type ever carried out. A number of significant and well-executed restorations have been carried out by Mark Fisher, Peter D. G. Jewkes, PITCHFORD AND GARSIDE, and the SOUTH ISLAND ORGAN COMPANY of Timaru, New Zealand. The facade pipe decoration of many organs has also been carefully restored, particularly by Marc Nobel and Christine Holmes. Significant historic instruments continue to be refurbished for new locations, in particular redundant organs by Norman and Beard (1898) for St. Patrick's Cathedral, Parramatta, New South Wales, and by Hill, Norman and Beard (1930) for Scotch College, Melbourne.

JOHN MAIDMENT

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AUSTRIA

Late Gothic and Renaissance

As early as the thirteenth century, an organ is first mentioned in Austrian history, in association with Salzburg Cathedral. Another organ was located in St. Stephan's Cathedral, Vienna (1334). No descriptions of these and the many other organs of this period elsewhere have survived. Records of the tonal configuration of the late Gothic organs of the fifteenth century have been preserved, though none of the instruments are still intact.

During the fifteenth and sixteenth centuries, Czech organ building played a major role in Austria; notable centers of organ building were established in Budweis and St. Joachimstal. The main organbuilders of this time included the Czechs Jan von Dobrau (Hans Behaim), Michael Knall, Friedrich Pfannmüller, Albrecht Rudner, and Joachim Rudner; the Austrians Leonhard von Salzburg and Gregor of Villach; and the German Jörg EBERT. There was much overlap between geographic areas at this time: German and Austrian organbuilders worked in Bohemia, and Bohemians worked in Austria.

In 1500, with Renaissance fine art beginning to differentiate itself from the Gothic tradition, organ building kept to the Gothic style to a great extent, with Italian organs preserving the "Gothic principle" the longest. A transformation from the late Gothic to the Renaissance organ took place gradually in the Czech lands, including Austria, in the possession of the Hapsburgs since 1255. Friedrich Pfannmüller (Oberpfalz) and Joachim and Albrecht Rudner (Budweis) were especially important in this transition. Pfannmüller's instrument in the cathedral and the St. Viet castle church in Prague. The organ, a Renaissance type with Diapason chorus, mixtures, and many ranks in all manuals, was considered by contemporaries to be "the most beautiful and largest [organ] of Christendom." Tirol was the capital of Austrian organ activity at the time, led by composer, organist, and organbuilder Paul Hofhaimer (1459–1537).

Baroque

In the mid-sixteenth century, the Tridentine Counter-Reformation limited the role of the organ to accompaniment of choral and congregational singing. Solo music during the Mass and the alternatim practices of the Renaissance were no longer permitted; the organ would simply double vocal parts. The Italian organ, which had changed little since its inception and was built with a purely vocal concept, was best suited for the task. Italian organs began to be ordered in Austria, although local builders began to make organs in the Italian style; organbuilders continued to exchange ideas as they traveled to different regions. Developments in the Principal rank and the progressive introduction of character stops of South German-Austrian organ led to a synthesis of Austrian and Italian organ types that produced the Italian-Austrian Baroque organ.

The seventeenth century featured tonal development as well as enrichment of organ casings. The main organ-building families of the seventeenth century came from Passau, Germany, near the Austrian border. These master builders of Passau defined the style of the time through their Brustwerks, many-ranked mixtures, and an increase in reed stops. The most significant surviving work of Andreas Putz (ca. 1580–1657) is the organ in Stift Schlägl in Upper Austria, completed in 1634. Johann Georg Freundt (1615–1678) built an organ from 1639 to 1642 in the Klosterneuburg monastery church near Vienna from the materials of two older organs. This new organ had three manuals, a rarity in seventeenth-century Austria, and a Pedal. It is one of the most important surviving organs in Austria from this century. The leading supplier of Italian-style organs during this period was the German Theodor W. S. Agathe, who also built organs in Bohemia.

Eighteenth Century

In the late 1600s, organbuilders began to experiment with organ tone based on the combination of individual stops. This led to the creation of personal styles, in which each builder could develop individual concepts of specification. Another Passauer, Joseph Christoph EGEDACHER II, built an organ in Waldsassen, Germany with thirty-two voices, divided among only two manuals and Pedal. This relatively large number of registers allowed Egedacher flexibility in registrational color. He later moved to Salzburg, where he built an organ in the cathedral. His son Johann Ignaz Ededacher's most important existing work is a 1731 organ in the monastery church in Zwettl, which demonstrates the influence on the Passau school of Egedacher's work. Johann David Sieber (Siebert) completed the organ in St. Michael's, Vienna, in 1714 in this style. This organ has forty voices, divided among a Great, Chancel organ, Continuo, and Pedal.

While the larger organs, reserved for the most important churches, clearly demonstrate the development in tone of the eighteenth century, small organs are the ones that mold the organ-building landscape. Self-taught organbuilder Nikolaus Rummel Sr. (b. ca. 1708) built the chancel organ in the monastery church in Wilhering in 1746. Lorenz Franz Richter (b. 1722) extensively shaped the organ-building landscape in northern Austria. His largest and most important existing instrument is at Kefermarkt, parish church.

One of Vienna's most important organbuilders was the German Johann Hencke from Westphalia. In 1752, he finished what is considered his best work, at Herzogenburg's monastery church. This organ boasts a richly colored tone by means of its metal and wooden Principals, a variety of flutes, strings, and reeds. An outstanding personality of the latter eighteenth century was Franz X. CHRISMANN, born in what is now Slovenia. A theologist and priest before turning to organ building, Chrismann's instruments reveal qualities both typical and prophetic of the future. He built the so-called Bruckner organ in St. Florian (1770; Anton Bruckner played this organ from 1848 to 1856). Its tonal conception featured character stops such as the Unda Maris, falsetti, and strings. In addition, Chrismann combined groups of registers to form single registers defined by a certain trait, as well as emphasizing foundation stops.

Early Romantic Period (1800–ca. 1870)

This era was an unfavorable one for the organ. The music of the Vienna Classical style demanded modes of expression not possible on the instrument. In a Roman Catholic country, the organ rarely played an independent role in church music. The "desacralization" of monasteries by Emperor Joseph II in the late eighteenth century, followed by the anticlerical policies of Napoleon I, contributed further to the overall bleak picture.

Organ building still followed Baroque traditions in the configuration of the manuals (Hauptwerk, Rückpositive, Brustwerk) and the short octave in the manuals and Pedal. Their dimensions remained, for the most part, as they were in the eighteenth century. But gradual changes also took place: the second manual lost its independence from the first, the single aliquots and the mixed voices decreased, and the tonal character became coarser. This transformation in style is exemplified by Ignaz Kober's organ in the monastery church in Heiligenkreuz. Much like Chrismann, Kober formed groups of character stops within similar registers that would lead to the orchestral expression of the later Romantic era.

Other organbuilders working within the Baroque tradition were Peter Hölzl, Josef Loyp, and Ludwig Moser (1807–1881). Carl Friedrich Ferdinand Buckow (1801–1864), who lived in Hirschberg, Silesia (now Jelenia Góra, Poland), finished his fiftieth organ in the Basilica Maria Treu, Vienna, in 1858. Anton Bruckner treasured this instrument, which remains one of the best in Vienna.

Late Romantic Period (1870s–1920s)

The end of the 1860s brought about a radical change to organ building. Instead of a traditional organ tone, an orchestral one was favored. The new type of organ was supposed to enable the smoothest possible crescendo and decrescendo; dynamic variation, not tone color, became the priority. The first manual became the loudest, the third the softest. Most organs had only fifteen to twenty registers; the Principal registers were reduced in favor of an increase in foundation stops. As long as organs with specifications of similar stops with mechanical slider-chests were built, polyphonic music could still be played, although the intonation was somewhat crude.

The largest organ factories of the time were RIEGER in Jägerndorf (now Krnov, Czech Republic) and MAURACHER in Salzburg. Matthäus Mauracher (1818–1884) was the best-known builder of the latter half of the nineteenth century. The Breinbauer family continued to make handcrafted instruments, building mainly small organs for rural country churches along the lines of models provided by the Cäcilienverein. Other smaller companies continued such traditional building methods after the turn of the century. Marcell Kaufmann (1849–1906) popularized the building of cone-chests in Vienna. Johann Georg Mayer (Feldkirch, 1846–1894) and Aton Behmann (Schwarzach, 1850–1932) also built cone-chests; but their sons Albert Mayer (1875–1969) and Josef Behmann (1880–1932) switched to building tubular-pneumatic actions.

Technical advances and changing tastes brought about innovations. Mechanical, pneumatic, and electro-pneumatic cone-chests with pneumatic or electro-pneumatic action were built. The ventil chests required by the cone-chests possessed the necessary clarity for performance of polyphonic music, but were not ideal for performing historic organ music. Crescendo pedals and similar devices were invented; mechanical action was totally given up at this time. Since pipes no longer required a certain proximity to the manuals, organ cases became deeper.

Late Romantic factory-made organ building, inspired by unbridled enthusiasm in technical progress, could only exist undisputed for thirty years or so. Finally, organists and even players of other instruments realized that the results of this exceptional enthusiasm were steering organ building away from actual organ tones. The organ's past was becoming its future.

The Effects of Reform Ideas in Austria

At the International Music Society convention in Vienna in 1909, during which Albert SCHWEITZER spoke about issues in organ building, a set of postulations for the Alsatian-German ORGAN REFORM MOVEMENT were codified. This included specifications for a new style of organ building, including leveled construction in the organ's interior and full octaves in the tonal groups. The Alsace reform idea was soon criticized as being "romanticized" and biased in favor of the Alsatian organ type. Wilibald GURLITT and Hans Henny JAHNN, both from Germany, wanted the North German Baroque organ to be incorporated in the new movement as well.

In Austria, composer Johann Nepomuk David, organbuilder Josef Mertin, and organ restorer Egon Krauss seized upon the reform ideas and won over organbuilder Wilhelm Zika, Sr. (1872–1955) to their cause. They stipulated that organs be built with manuals differentiated in character from one another and with mechanical slider-chests with stop channels. Zika built an experimental instrument in the Lutheran church in Wels (1929) that garnered less interest in Austria than it did in Switzerland and Germany.

At first, the new thinking in organ building did not prevail among Roman Catholic authorities in Austria. In 1928, the church even reaffirmed the long-held principle that the organ should accompany congregational singing, the choir, and the liturgy. Since organists could perform this function best if the manuals allowed them to face the choir and the altar comfortably, a nonmechanical action was necessary. Ferdinand Molzer and Ferdinand Kauffmann (1910–1965) continued to build factory-made organs. Huge organs with electro-pneumatic cone-chests (Vienna, St. Stephan's Cathedral, 1960; 4/125) were a definite setback in the realization of reform ideas.

Instead, the transformation of organ-building styles occurred in stages. First, specifications became more "Baroque" without the intonation of the organ changing substantially; however, pneumatic or electro-pneumatic action was retained. Then pneumatic or electrically powered slider-chests were finally replaced by mechanical slider-chests. Possessing a relentlessly neobaroque sound at the beginning, organs were developed that possessed a round, soft tone that sparkles in the plenum. With this, the connection had been made to the Austrian Baroque organ. There are still some differences between the Baroque and the neobaroque Austrian organ, notably the retention of full Swell divisions in many instruments. But the Austrian NEOCLASSICAL ORGAN would retain a character different from that of the German reform instrument.

During World War II, the development of organ building came to a standstill in Austria. In 1954, Danish builder Sybrand ZACHARIASSEN gave a lecture at the Second International Convention for Catholic Church Music in which he advocated enclosed cases (to help project the sound), slider-chests, and mechanical action. This lecture inspired the Austrian Baroque or neoclassical reform movement, complete with its own interpretation of the WERKPRINZIP. Among the major organbuilders of this time was Johann Pirchner the Younger (b. 1928), who built the first modern Austrian tracker organ at the Music Academy in Vienna (2/14). Helmut Kögler, who took over Wilhelm Zika's workshops (now Orgelbauanstalt Kögler) in 1972, manufactures countless organs with mechanical slider-chests. Josef von GLATTER-GÖTZ and his sons built mechanical tracker organs, among which was a six-stop positive that became a popular model and was displayed at the 1950 World's Fair in Chicago. After this, Glatter-Götz (having moved Rieger to Schwarzach, Austria) sold organs in Africa, America, Asia, and Australia as well as in Europe. Among other builders were Gregor HRADETZKY, who built a organ for the Stiftskirche in Wilten/Innsbruck, Wilten (1964; 4/44; Oberwerk with Swell); his son Gerhard Hradetzky (b. 1944), who founded his own workshop and took as inspiration the Austrian organ building of the early nineteenth century with its Austrian-Italian tonal orientation; and Herbert Gollini (b. 1927), who rebuilt the organ at Hohenems, St. Karl (1988; 3/40).

MAXIMILIAN ZWEIMÜLLER

Translated by Michelle Maczka

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AUTOMATIC PLAYERS

SEE MECHANICAL ORGAN; PLAYER PIPE ORGAN

B

BACKFALL

In mechanical balanced action, a horizontal bar with a central fulcrum or bridge that transfers individual key action (directly or indirectly) to the tracker that operates the windchest pallet. In all actions, depressing the manual key (also based on a central fulcrum, or rail) causes the back of the key to rise. In one system, this causes a vertical sticker to rise, in turn pushing the back end of the backfall upward. This motion pulls down a tracker, attached to the backfall's front end, which pulls down the pallet. In another system, the back end of the key pulls up a tracker that pulls up the front end of the backfall (now located below key level); the tracker attached to the back end pulls down on the pallet as before. These two systems apply to smaller instruments where the key action is located more or less directly under its pallet box (i.e., where there is no rollerboard). In larger instruments where action is displaced by rollerboards, the front end of the backfall rests directly on the back end of the key. When the backfall's front end is engaged and rises, the back end falls, causing the attached tracker to rotate the roller mechanism that ultimately engages the pallet tracker.

The backfall is part of a refinement of the suspended action that predates seventeenth-century balanced action by more than a century. It continued to play a key role in the Barker lever action of the early nineteenth century; with the advent of pneumatic mechanisms later that century, tracker action gave way to multiple pneumatic motors and lead tubing to carry the action. With the Organ Reform Movement of the early twentieth century (and the postwar interest in replicating centuries-old instruments), the backfall as part of tracker actions has been revived.

See also **Action; Balancier**

Richard Kassel

BADER

German family of organbuilders, active in the Low Countries. Daniel Bader (fl. 1600–ca. 1638), the first member of the family known to have been an organbuilder, was a pupil of the Brabantine builder Arendt (Arnold) Lampeler van Mill. Bader worked primarily in Belgium, but is best known for rebuilding (1612) an organ by Lampeler van Mill (Münster, St. Paulus-Dom, 1588). The 1588 organ replaced a 1536 organ built to replace yet another, which had been destroyed by Anabaptists in 1534. Bader's son Arnold repaired the 1588/1612 instrument in 1624. Bader moved to Arnsberg, Westphalia in 1595. In 1600, he became a member of the St. Luke's guild in Antwerp, where he built an organ for the St. Jacobskerk in 1603. Back in Westphalia, he built a small positive for the Arnsberg castle around 1610. He probably died in 1638 at Appingedam while working at the organ of the St. Nicolaaskerk.

Four of Daniel's sons became organbuilders: Hans Henrich Bader (d. ca. 1680), Ernst Bader, Arnold Bader (b. 1601; d. Dronrijp, Friesland, 1656 or 1657), and Tobias Bader (d. Arum, Friesland, 1666). Arnold received the commission for a two-manual organ at the Petrikirche in Münster in 1624. In 1626, he married the daughter of organbuilder Johann Busse, with whom he probably worked. In 1645, Arnold and Tobias became citizens of Leeuwarden. Arnold died in 1656 or 1657 while working at a new organ in Dronrijp; Tobias completed both this organ and another in Ternaard (both extant); he probably died in 1666, shortly after starting work at a new organ in Arum.

Hans Henrich worked with Arnold in Münster in 1624. In 1637, he built a new organ for Zutphen, St. Walburgiskerk (1639–43), in part assisted by Arnold and Tobias. In 1648, Hans Henrich completed a new organ for the St. Willibrordikirche in Wesel, Westphalia. Three of Hans Henrich's sons were organbuilders: Conrad Bader (b. ca. 1625; d. 12 Dec 1667); Tobias Bader II (b. after 1633; d. 12 June 1690), and Johann Gottfried Bader (b. after 1633; d. after 1701). Joseph Bader and Pieter Bader—apparently sons of Johann Gottfried—were active as organbuilders near Brussels (1720–45).

The Zutphen organ, rebuilt by Timpe in 1813, is undoubtedly the finest surviving example of a Bader organ. Typical Westphalian features in Zutphen are the independent Pedal with 16' stops, unknown in the Netherlands until the second half of the century; the 4' Flutes on Hoofdwerk and Rugwerk; the small number of high mixtures; and finally the high Chorton pitch. Another characteristic of Hans Henrich's work is his lifelong use of the old-fashioned spring-chest. Arnold and Tobias adjusted more to the style of the Dutch organbuilders around them.

JAN-PIET KNIJFF

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BAILLIE-HAMILTON, JAMES (JOHN BUCHANAN) (1837–AFTER 1926)

Scottish inventor. A man of considerable financial means, he dedicated his time to the VOCALION, a form of REED ORGAN. As originally conceived, the Vocalion seems to have been influenced by the Aeolian harp as much as the free reed, involving wind-driven strings. An apparatus of this sort was demonstrated at meetings of the Royal Society in 1875 and 1883, but with mixed results. The original idea of the string gave way to a wire as an extension of the reed, or a coil attached to it; for practical reasons this was dropped in favor of a system utilizing large free reeds winded by high pressure in conjunction with carefully chosen resonators or qualifying tubes of the appropriate size and shape. Baillie-Hamilton was influenced by Hermann Smith (d. ca. 1914), who had spent much time in researching the properties of free reeds. He published the results of his work in articles in *The English Mechanic*; he provided Alexander Ellis (1814–1890) with information for the section of musical reeds in Ellis's "Appendix XX" to Helmholtz's *On the Sensations of Tone*. In a letter written to *Musical Opinion* in the early 1880s, Smith apparently claimed that Baillie-Hamilton had appropriated his ideas for use in the Vocalion; the letter was never published.

The Vocalion was successfully exhibited at Westminster Abbey and the International Inventions Exhibition of 1885. The firm of HILL AND SON produced the instrument in England on a limited basis, but each Vocalion seems to have been one of a kind and largely handmade. In the late 1870s Baillie-Hamilton moved his operations to the United States; by 1884 his address was given on patents as "Boston, Massachusetts," and he had dropped the hyphen from his name. He apparently joined with the American reed organ manufacturing firm of MASON AND HAMLIN to develop the Vocalion further, but the collaboration was not successful. Baillie-Hamilton then worked with the Canadian organbuilder WARREN, with whom he remained for about two years perfecting the "Canadian Vocalion." He returned to England with Warren to raise funds, but they failed to attract investors. By 1886 Baillie-Hamilton was back in the UNITED STATES with enough capital to establish the Hamilton Vocalion Manufacturing Company at Worcester, Massachusetts. This firm failed in 1887 or 1888, and the Vocalion passed into other hands. Vocalion production was terminated by the last of its owners, the ÆOLIAN COMPANY, shortly after its acquisition in 1903, although Vocalion-type windchests were incorporated in Orchestrelle player organs until about 1920.

Baillie-Hamilton returned to England; in about 1926 he was living in Portman Square, London. His last patent was for a combined piano and reed organ in which the windchest incorporated the piano soundboard itself, thus at least partially returning to the original Vocalion concept of combined reed and string.

JAMES HOWARD RICHARDS

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BALANCIER

French for backfall, the lever that transmits and often changes the direction of motion from either a sticker or a tracker to another sticker or tracker. George A. AUDSLEY defines three categories: one that makes use of the fulcrum between the power source and the weight, a common lever in organ building; one that places the weight between the power and the fulcrum—for example, a key body linked to a suspended action; and, the rarest form of lever encountered in organ building, one that situates the weight at one end of the backfall with the power applied between the weight and the fulcrum, a principle sometimes used to gear the key-to-pallet travel ratio up or down as required.

The use of the backfall in French organs before the advent of the console and BARKER LEVER was restrained, as most Grand Orgue, Récit, and Pédale divisions used suspended action. The Echo and *Positif á dos*, however, did make use of an elongated series of backfall levers, collectively called a fanboard, which transmitted motion from the keys (via stickers in the case of the Positif) to the windchest. The Positif fanboard, located in the floor under the player‘s bench, radiated (splayed) outward from the keys toward the pipechests. The fanboard allowed the Positif to use a chromatic pipe arrangement (except for the lowest octave, which used a rollerboard and was placed diatonically on the chest).

The balancier assumed a primary role in nineteenth-century actions, necessitated by detached consoles (rather than the attached keydesk) and the Barker lever. The complexity caused by the number of directional changes in action between the console and the windchest, and the linkage between the output of the Barker lever and the pallet in the windchest, encouraged the use of the balancier until the proliferation of electric actions in France following World War I.

See also **Action**

JESSE E. ESCHBACH

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BALBIANI

SEE VEGEZZI-BOSSI

BALDWIN

American instrument-building firm. Dwight Hamilton Baldwin (1821–1899), a minister educated at Oberlin College, was an itinerant music teacher who settled in Cincinnati in 1857, teaching music in the public schools. That year, Baldwin and Luther Whiting Mason, son of Lowell Mason and brother of Henry Mason (co-founder of MASON AND HAMLIN), published several books of songs. The most prominent music educator in the area, Baldwin was frequently called upon for advice on the purchase of musical instruments. Capitalizing on his reputation, he became a retail dealer of pianos and organs in Cincinnati around 1862. In 1866 Lucien Wulsin (1845–1912) was hired as a clerk, becoming a partner in 1873 with the formation of the D. H. Baldwin Company. By 1875 the firm was selling 2,500 pianos and organs annually. A branch at Louisville, Kentucky, was opened in 1877 under the charge of Robert A. Johnson (1838–1884), who became a partner in 1880. After Johnson's death, three other partners joined the firm: Albert A. Van Buren, George W. Armstrong Jr., and Lucien Wulsin's younger brother Clarence. The firm became one of the largest retailers of keyboard instruments in the Midwest, with franchises including Steinway and Sons, Chickering and Sons, Decker Bros., J. and C. Fischer, Haines Brothers, Vose, and the ESTEY Organ Company. In 1899 Baldwin died, leaving the bulk of his holdings in the business to the Presbyterian Church, and the D. H. Baldwin Company was dissolved. In 1903, Lucien Wulsin and George Armstrong bought control of the company, with Wulsin serving as chief executive officer until 1912, followed by Armstrong until 1926, and Lucien Wulsin, Jr. (1889–1964) to 1964.

Baldwin's manufacturing activities began in Chicago in 1889 with the purchase of the Hamilton Organ Company of Chicago and the production of Monarch and Hamilton reed organs. In the late 1920s the firm began a research and development program that resulted in the introduction of the Baldwin ELECTRONIC ORGAN in 1946. This venture also laid the groundwork for Baldwin's extensive future involvement in electronics. Like other firms, Baldwin's manufacturing was altered to aid the war effort during World War II; in 1946 keyboard production resumed. By 1958, factories had been established in Arkansas and Mississippi; by 1972, only the executive offices remained at Cincinnati. In the 1960s, Baldwin acquired the prestigious German piano-making firm of Bechstein. In 1967 a factory was opened in Juárez, Mexico, for the manufacture of electronic equipment and piano actions. This period saw the increased acquisition of electronic firms; forty-two corporate purchases were recorded between 1968 and 1982. The Baldwin Piano and Organ Company was reduced to a small division of a huge corporation called Baldwin United.

During 1982–83, after the acquisition of the Mortgage Guarantee Insurance Company, rising interest rates forced Baldwin United to file for Chapter 11 bankruptcy. The executive staff of the profitable piano and organ division negotiated a leveraged buyout in 1984. In the 1980s Baldwin Piano and Organ sold Bechstein. When Baldwin purchased the Wurlitzer firm (est. 1856) in 1988, it also acquired the total assets of the Æolian Company (now Corporation), which Wurlitzer had acquired in 1985. Over the years, Æolian had acquired many notable piano names, including Chickering and Sons.

Baldwin no longer made electronic church organs, instead devoting its electronics expertise to the development of digital pianos and electronic player pianos. During more recent years Baldwin suffered financial losses and mismanagement; by early 2001, little remained of Baldwin but its name, a huge debt, and two struggling piano factories. In November 2001 the Gibson Guitar Company bought Baldwin from General Electric for $22 million. Pianos bearing the Chickering and Wurlitzer names were to be made abroad; pianos bearing the Baldwin name were to remain American-built high-quality instruments in limited numbers. The Baldwin electronic organ was not revived.

James Howard Richards

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BAND ORGAN

See Mechanical Organ

BARBIER, NICOLAS (FL. CA. 1580)

Probably of Flemish origin, Barbier was an important late-sixteenth-century builder in Normandy. The organ he built at Gisors, St. Gervais-et-St.-Protais (1577–82; rest. and Récit added, J.-B. N. Lefèvre, 1769–74; destr. 1940) is regarded as one of the most valuable in establishing the basis for the French classical organ. Although it is sometimes referred to as the “first French classical organ,” several further developments would take place before the typical French classical specification emerged. Most of the Gisors organ’s features were distinctly Flemish, of the type often associated with the Langhedul family; it is not known whether the Langheduls might have influenced Barbier, or what their relationship was. Typical of many Flemish instruments, the Gisors organ (2/21) had a Pedal of only two 8’ stops, including a reed (Sackbut), with its pipes placed in windchests to either side of the main case. The Positif (Positiv) was not separate, but incorporated within the main case of the Grand Orgue, which used a spring-chest. The manuals had a compass of 48 notes (C-c''', no C-♯), no individual Tierce rank, a two-rank Nasard (Rauschquinte), a “Regal serving as a Voix Humaine,” and a Petite Quinte or Larigot 1-1/3' as the only mutation in the Positif. This organ seemed to influence the normal scheme for organs built in France up through the reign of Louis XIV.

Douglas E. Bush

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BARDEN, NELSON C. (B. 1934)

Founder and president of Nelson Barden Associates, a Boston-based restoration firm that specializes in electro-pneumatic pipe organs. Barden was one of the first restorers to incorporate historically accurate and sensitive techniques in such restorations. Along with Edward Millington Stout III in San Francisco and the Thompson-Allen Company of New Haven, Connecticut, Barden’s work has largely redefined the standards in this field.

Barden went into business in 1957, after serving an apprenticeship with Roy E. H. Carison of Boston. In the 1960s he developed an interest in the Ampico Reproducing Piano. In partnership with Kenneth Clark, Barden restored dozens of Ampico pianos and other automata. During these years, the pair became acquainted with the Welte Organ Company’s Philharmonic Pipe Player Organ, eventually attaching one to the Welte organ in the Church of the Covenant, Boston. Other early restoration efforts included work for the Museum of Fine Arts, Boston, and the New England Society for the Preservation of Antiquities.

Barden's work is inspired by the automatic instrument field, where museum-quality restorations are more common. His first significant restoration was in the First Church of Christ, Scientist, Cambridge, Massachusetts (W. W. Kimball, 1936; 3/51; 1977–79). This was followed by Church of the Advent, Boston (Æolian-Skinner, 1936; 3/77; 1979–81); Old South Church, Boston (Skinner, 1921; 4/114; 1988–90); and Church of the Good Shepherd, Jacksonville, Florida (Skinner, 1929; 4/47; 1990–92).

The most impressive work of Barden has been the creation of a newly rebuilt and computerized player pipe organ (1994) based on two Boston University automatic players which he had previously restored: a 1930 Skinner (1981–83; 2/12) and a 1930 Æolian (1983–87; 3/23). Supplementary pipework and percussions from other Skinner and Æolian organs were added; Welte and Moller players were connected to the Skinner and Æolian Duo-Art systems, creating a library of more than 2,500 roll selections. The instrument can now play from a roll produced by a digitalized system on which all facets of performance can be edited. The 62-rank hybrid organ is designed for walk-through tours, and a mock-console exhibit mimics the notes and stops as they operate.

Experience with the Welte player and the roll recordings of Edwin H. Lemare prompted Barden to research that organist's life and history. This resulted in a biography published serially in the *American Organist* and in *The Organ* (1986). Barden's research of the period 1890–1940 has contributed to the revival of interest in the American symphonic organ and the art of transcription playing.

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BARKER, CHARLES S(PACKMAN) (1805–1879)

English inventor and organbuilder. He is considered the inventor of the BARKER LEVER (first patented in 1839), a wind-driven (pneumatic) device employed in assisting the playing of large tracker organs where the weight of the touch is uncomfortably heavy. The invention of this device revolutionized the organ.

Barker was baptized on 7 January 1805 in Walcot, Bath (Somerset). Very little is known about his training and education. He arrived in France in 1837 and met the family of Aristide CAVAILLÉ-COLL, then working on the organ for the basilica of St. Denis near Paris. The collaboration with Cavaillé-Coll ended in 1841, just a few weeks before the dedication of the St. Denis organ. Barker's reception in France led him to take up residence in Paris, but his primary residence was still in England; he never took up French citizenship or permanent residency.

Barker became shop manager of the DAUBLAINE-CALLINET firm in Paris in June 1841, retaining this position until the firm's sale to MERKLIN-Schütze of Brussels in 1855. During this time he oversaw the building of new organs at Paris, St. Eustache (1844; 4/69) and the cathedrals of Pontoise and Nîmes, as well as the rebuild at Paris, St. Sulpice (1846). He directed the factory preparations for the National Industrial Products Exhibitions of 1844 and 1849 (Paris) and the

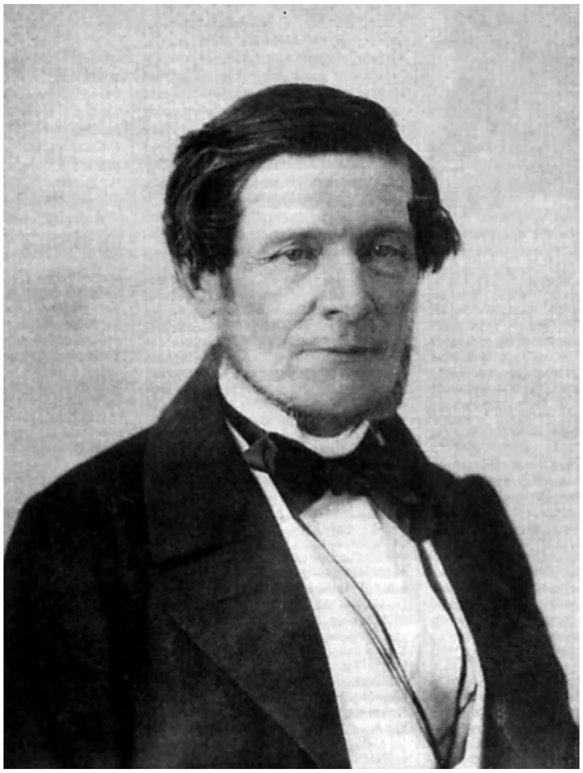

Fig. 12. Charles Spackman Barker.

1851 Great Exhibition in London. In 1855 Barker exhibited a small, improved model of his pneumatic lever at the World Exhibition in Paris that year. He won a First Class Gold Medal and was made a Chevalier of the Legion of Honor in 1855.

Barker left Joseph Merklin's shop in 1857 and went into partnership with Charles Verschneider (a voicer). He started working on the application of electricity to organ building, and soon became a major pioneer in the field. The 1866 instrument by Barker and Verschneider in Salons-de-Provence is ostensibly the first electric-action organ in the world. Oddly enough, the request for admission of the firm to the 1867 World Exhibition was rejected. The outbreak of the Franco-Prussian War in 1870 and the subsequent expulsion of aliens forced Barker to return to England, where he died in Maidstone, Kent, on 26 November 1879.

During his career, Barker gained patents on four occasions. The 1839 patent covered the Barker lever; the 1844 patent is general in nature. An 1855 patent covered "improvements made on a device for lightening the touch of church keyboards," while a 1862 patent was given him for "improvements made in the building of organs, pneumato-electric [*sic*] device."

See also **Action**

DAVID SMIT

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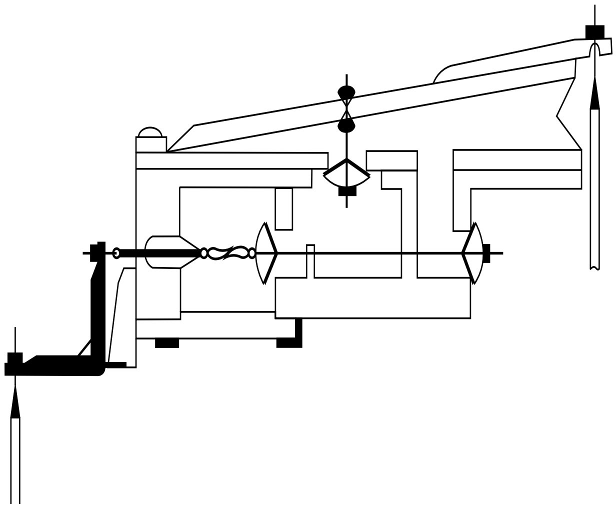

Fig. 13. Barker lever.

BARKER LEVER

An aid to organ ACTION, motivated by a small pneumatic motor inserted between a key and its pallet in the windchest; also called a Barker machine. The device became routine in French work after 1840, due to the new aesthetic dictates of the period requiring a greater wind supply, evenness of wind, and frequent coupling of two or more manuals. This pneumatic motor, introduced into France in 1839 by Charles S. BARKER (whose name became synonymous with it), is controlled easily by minimal finger action, regardless of the number of pallets to be opened.

The pneumatic motor itself, working under high wind pressure, is activated by a small pallet directly linked by traditional tracker action to a given key. When activated, the pneumatic pouch expands, triggering the sticker, backfalls, trackers, and pallets attached to it. Manual coupling and suboctave coupling occur at the "output" end of the Barker lever. Within a given specification of Aristide CAVAILLÉ-COLL, the presence of a Barker machine may often be deduced by the inclusion of suboctave (Octaves Graves) couplers; such couplers were rarely found in divisions using unassisted mechanical action. The majority of nineteenth-century instruments were not equipped with Barker levers on every division; two notable exceptions were St. Sulpice, Paris (1862), and Notre-Dame de Paris (1868).

Early accounts of the Barker lever criticized the abrupt change of touch when progressing from a Barker-assisted manual to an unassisted manual. This may have before led to the development of the Grand-Orgue sur Machine pedal, which let the player disengage the Grand Orgue division while allowing the previously coupled manuals to continue with the Barker lever in force. The player could produce the effect of a manual change by releasing the Grand Orgue sur Machine pedal (and other couplers if desired) without ever leaving the Grand Orgue manual itself, keeping the Barker "touch" intact throughout a given piece of music.

JESSE E. ESCHBACH

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BAROQUE ORGAN

From the end of the Renaissance until the end of the eighteenth century, the organ remained essentially the same; there were a few technical changes (winding, bellows), but as a whole the Baroque organ remained the same as its Renaissance predecessor. WEDGE BELLOWS were perfected and were of two types: single and multifold. They were made of wooden boards with the ribs glued to leather strips. They could be operated by hands (smaller organs) or by feet (big church organs). For the larger bellows, levers were used. WINDING was more even with these bellows than with the earlier cuneiform (forge) BELLOWS. A weight placed at the top end of the bellows produced air pressure. Sometimes, in later instruments, different types of wind RESERVOIRS were placed between the bellows and the WINDCHEST (e. g., feeder bellows, box-bellows, and *soufflet à lanterne*, or lantern bellows). Valves allowed for sucking in the air but closed automatically by expelling the wind.

Small DIVISIONS such as the RÜCKPOSITIV or BRUSTWERK were added to the basic trio of HAUPTWERK, OBERWERK, and PEDAL. The number of stops increased, providing a richer and more varied sonority. Sometimes, because of technical specifications (narrow pallets and/or channels), it was, in practice, impossible to use all the theoretically possible combinations of stops. The *Sperrventil* (a valve that prevents excess air from entering a specific chest or saves it for another chest) made it possible to preselect the stops. The transmission system between the keys and the pipechests was based on the ROLLERBOARD, with intervening devices such as STICKERS, TRACKERS, and BACKFALLS.

In the Low Countries, the COUPLER (described by Michael PRAETORIUS, 1619), permitting the playing of different divisions at the same time, was incorporated from the first quarter of the sixteenth century. The post-BLOCKWERK structure of the organ (later called the WERKPRINZIP, featuring distinctive, independent chests) began to evolve during the fourteenth century but reached its fulfillment during the Baroque period. However, differences remained between northern and southern Europe, heightened by the Reformation as well as by the many wars. The Lutherans encouraged the use of the organ and permitted solo performance in the service. Calvinists banned it, at least in the beginning; later on, organs were allowed to accompany the singing of psalms. Originally, Roman Catholic liturgy featured the organ in solo and ALTERNATIM settings; during the Counter-Reformation, the church limited the organ to an accompanying role, leading to a different type of instrument.

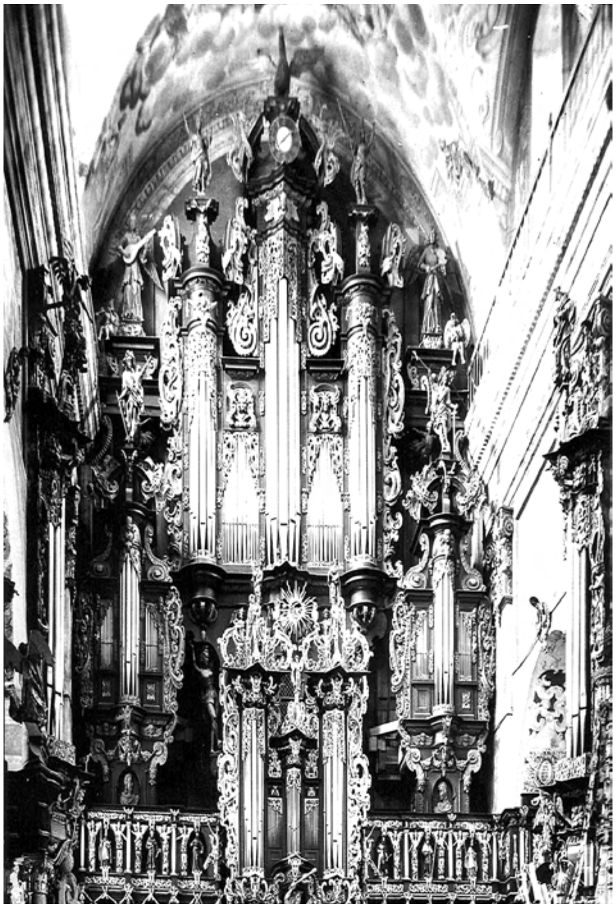

Fig. 14. A Polish Baroque treasure: Glowinski and Studzinski's instrument at Lezajsk, Bernardine Basilica (1618–28).

In England, little is known about the organs before the Reformation. Usually, they had only one manual, few stops, and no pedal. The High (Anglican) Church admitted them in 1610, but the destruction of church organs was an element of the Civil War (1642–49). Under the commonwealth, organs were forbidden. With the Restoration (1660), organs were reintroduced; these began to have two manuals, but still lacked a pedal, mixture stops, or reeds. In 1720 the PULL-DOWN pedal appeared for the first time in England. An important development was the introduction of the SWELL (an enclosed ECHO) by Abraham Jordan, applied for the first time in the four-manual organ at St. Magnus, London Bridge (1712).

The typical North German organ was created by Arp SCHNITGER, who made the Pedal totally independent and introduced many reed stops. In southern Europe, the typical organ offered only a few stops, the Pedal was integrated into manual divisions (via pull-downs), and the FACADE was fairly flat and symmetrical. During the eighteenth century, more string stops were added. Two-manual organs were limited to larger churches and abbeys; four-manual instruments are rare (e.g., the abbey at Ottobeuren). In the Low Countries, organs developed according to the prevailing religion: the (northern) Netherlands (now independent) was mostly Calvinist (Reformed) and used organs with strong sonorities to accompany the singing of psalms (from 1650 onward). The southern Netherlands (Flanders, the future Belgium) was Roman Catholic; most organs were one-manual instruments with no independent pedal. In the eighteenth century, Johannes Baptista Forceville made a synthesis between Flemish and German organbuilding traditions (Antwerp, St. Carolus Borromeus).

In Scandinavia, only Sweden had important organs prior to the Reformation; thereafter, a large number of POSITIVES were built. In Norway, organs had appeared before the Reformation but were limited to larger towns; the Baroque era saw the arrival of instruments in towns and villages. Denmark has a long history of organ building, but the first builders were mainly foreigners, among them Hans BREBUS. In the Baltic Sea region, the Nordic War (1700–1721) caused the destruction of numerous organs in Finland and Estonia; only one positive from a church of Nauro (Finland) is preserved, now in the National Museum, Helsinki. In Catholic Latvia and in Lithuania, organs usually had only one manual. Typical for these countries was the use of Zimbelstern and Pauken stops. Although Poland is known to have had organs as early as the twelfth century, only one prospect survives from the beginning of the seventeenth century.

Western Europe saw different developments. In France, facades were ornately, even excessively decorated in the pre-Rococo manner (influenced by Italian cases). The French Baroque organ, described in detail by François BÉDOS DE CELLES, featured the DIVIDED STOP, allotting different halves of the manual to the RÉCIT and Echo divisions. In Calvinist Switzerland, many organs were destroyed as "papal" and "pagan." Southern Europe brought yet more organ types. In Italy the facade was usually divided into five chests. The pull-down pedal had twelve to seventeen keys and was attached to the single keyboard.

In Portugal the seventeenth century marked a decline. The riches of the new Latin American colony, Brazil, brought new capital in the eighteenth century; many foreign organbuilders came to Portugal to build one-manual instruments with richly decorated cases. Spanish organbuilders preferred less ornate cases but with distinctive Trumpet stops horizontally protruding into the nave (EN CHAMADE REEDS). Pedals were fairly simple, much like those in France, but there were experiments with tuning that led to enharmonic keys (SUBSEMITONES).

Organs appeared in the New World, first in Mexico where they were introduced by Pedro de Gante about 1530. The Spanish introduced organs to Ecuador, Peru, Venezuela, and Bolivia, the Portuguese to Brazil. The future UNITED STATES had its first organs around 1630; seventeen Spanish-style organs were built in New Mexico. The first American citizen to build an organ was Johann Gottlob KLEMM—a three-manual organ for the Trinity Church of New York. The first Canadian builder was Paul Jourdain dit Labrosse, who made a seven-stop organ for Quebec Cathedral (1721–23).
See also **Organ Mass**

FERDINAND J. DE HEN

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BÄRPFEIFE

A reed stop of the Regal class, having been made with a variety of resonator shapes. Bärpfeife is one of the oldest organ stops, having been introduced in the mid-1500s by NIEHOFF. The most common consisted of two truncated cones joined at the base. Often an additional truncated cone was added to the top. The tone of the Bärpfeife has been described as soft, growling, and smothered. James Ingall Wedgwood reports that it was intended to imitate the growling of a bear, hence the name; but *The New Grove Organ* claims that "the term has nothing to do with growling bears, however coarse the tone." While some sources consider Bärpfeife to be a synonym for the Dutch Baarpijp or Baarpyp, others define the latter as a tapered flue stop similar to the Gemshorn, used as early as 1735.

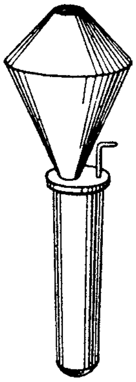

Fig. 15. Bärpfeife.

See also **Stop**

Edward L. Stauff

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BARREL ORGAN

See Mechanical Organ; Player Pipe Organ

BASSET HORN/CORNO DI BASSETTO

An imitative reed stop, similar to the Clarinet, but richer, found in 8' and less often 16' form; based on the orchestral tenor clarinet of the same name (used by Wolfgang Amadeus Mozart). The stop was found in nineteenth-century German instruments (Walcker) as a free reed; but English builders (Hill, Gray and Davison, Willis) opted for a striking reed, usually cylindrical (sometimes inverted conical, occasionally with a bell).

See also **Stop**

BASSOON/BAJÓN

See Fagotto/Bassoon/Bajón

BÄTZ

Family of organbuilders active for three generations in the Netherlands. Johann Heinrich Hartmann Bätz (b. Frankenroda, Saxony, 1709; d. 1770) learned organ building with Christoph Thielemann of Gotha. Finishing his apprenticeship in 1733, Bätz left his homeland and came to the Netherlands, where he worked on the Haarlem, St. Bavo's organ with its builder, Christian Müller, also originally German. Bätz established his own workshop in Utrecht in 1739 and built sixteen organs before his death. His largest instruments were made for Gorinchem, Grote- of Janskerk (1761; repl. C. G. F. Witte, 1853), The Hague, Evangelisch-Lutherse Kerk (1762), Woerden, Petruskerk (1768), and Zierikzee, Grote- of St. Lievens Monsterkerk (1770; destr. 1832). His two-manual instruments normally had a broad-sounding Hoofdwerk with a more brilliant Rugwerk. The Bovenwerk, when present, featured primarily Flute stops.

Gideon Thomas Bätz (1751–1820) and Christoffel Bätz (1755–1800), sons of Johann Heinrich Hartmann Bätz, represent the second generation of builders. Johann Heinrich Wilhelm Bätz, brother of Johann Heinrich Hartmann Bätz, conducted the business with his nephews after his brother's death until Gideon Thomas came of age (1772). In 1778, Christoffel went his separate way, although he continued to assist his brother from time to time. Between them, Gideon Thomas and Christoffel built just over twenty organs, most of them one-manual instruments. A more Rococo style is present in their work.

The third generation consists of Jonathan Bätz (1787–1849) and Johan Martin Willem Bätz (1789–1836), sons of Christoffel. Johan Martin Willem, who was making pianos in Amsterdam, joined his uncle, Gideon Thomas, in 1818. After their uncle's death in 1820, the two brothers continued the business. Johan Martin Willem left the workshop in 1831 and did little organ building thereafter. In 1833, Jonathan took on as partner Christian Gottlieb Friedrich Witte, who had worked for the firm since 1826. Witte in turn married the granddaughter of Gideon Thomas in 1839. After Jonathan's death in 1849, Witte took over the firm but retained the Bätz name. In the period between 1820 and 1849, twenty-one instruments were built, among them three instruments, each with three manuals and a Rugwerk division: Amsterdam, Ronde Lutherse Kerk (1830), Utrecht, Cathedral (1831; praised by Cavaillé-Coll), and Delft, Nieuwe Kerk (1840). The Amsterdam and Utrecht instruments had vorgan cases designed by the Belgian architect Tilman François Suys, the first in neoclassical style and the second with neogothic tendencies.

The third generation continued to build organs in the traditional Dutch manner. Like their uncle and grandfather, Jonathan and Johan Martin Willem Bätz were excellent craftsmen who used high-quality materials in their instruments. While much of their work is by nature conservative—mechanical key and stop actions, slider-chests, fully developed Principal choruses, and Rugwerk divisions—the tonal approach inclined toward a fuller sound, following nineteenth-century trends. The second manual was normally a Bovenwerk with stopped flutes and string stops for softer effects and accompaniment. While not as classical as the eighteenth-century organs, the third generation's instruments remained excellent vehicles to accompany congregational singing in the Dutch Reformed and Lutheran Churches of the Netherlands.

James L. Wallmann

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BAUERFLÖTE

The names *Bauerflöte*, *Bauernflöte*, *Bauerpfeife*, and *Bauernpfeife* all refer to a FLUTE stop of 8', 4', 2', or 1' pitch, dating from around 1550. It is more commonly found at the higher pitches. Different sources disagree as to whether its scale is large or small, and whether the pipes are open or stopped, or have chimneys like the Rohrflöte. Its tone is clear and, in the higher pitches, whistlelike. In German organs it frequently appears in the Pedal at 2' or 1' pitch, where it is used for playing the melody in choral preludes.

See also **Stop**

EDWARD L. STAUFF

BAVARIA

The "free state" of Bavaria (Bayern) has one constant throughout its history: the continuing importance of the Roman Catholic Church, which by the seventh century had filled the region with bishoprics, places of worship, and monasteries. The Reformation made inroads, and the struggle between church and state intensified from the seventeenth century onward, but modern Bavaria and the state of North Rhine–Westphalia, constituted in 1947, remain the German stronghold for Catholicism, with two-thirds of the Bavarian population identified with that religion. Another essential of Bavarian history is the continual warfare within and without the duchy (as it was known from the fourteenth century on) and the resulting shifting of alliances throughout its history. Bavaria was a part of the Holy Roman Empire; the duchy and the Holy See did not always see eye to eye. The duchy endured the Thirty Years' War (1618–48), the War of the Spanish Succession (1701–13), and the roller-coaster ride of the French Revolution and Napoleonic eras (1789–1815), during which Bavaria declared neutrality, was occupied twice, fought on both sides, and signed treaties that returned the Austrian lands Bavaria held in exchange for what is now Bavarian territory. It bounced between alliance with and fear of Prussia, but eventually became a willing partner in Bismarck's German Empire (1871).

During the late eighteenth century, Catholic Germany came under the Enlightenment's influence, under the leadership of Emperor Joseph II; one consequence was the secularization and confiscation of monastic and other institutional property (a process already undertaken by Protestant Germany after the Thirty Years' War). The Bavarian electors (rulers) took over and closed mendicant orders and religious foundations; by 1800, all orders, especially the Jesuits, had lost all property and revenues. Some abbeys became hospitals, dormitories, or army barracks, or were distributed to lesser members of the ruling class. Catholic Bavaria was especially hard-hit, losing abbeys in Andechs, Augsburg, Benediktbeuern, Kempten, Metten, Michelsberg (Bamberg), Oberaltaich, Ottobeu(e)rn, Ratisbon (Regensburg), Scheyern, Tegernsee, and Wessobrunn. While many regained their religious role during the nineteenth century, the orders now had little impact on secular matters.

The organs of Bavaria had benefited from the limited impact of the Reformation within its borders, but the continual warfare and dissolution of the monasteries led to the loss of several instruments. Only in the post–World War II era has Bavaria been in a position to restore or replace these presecularization instruments. Unlike other German regions, Bavaria's importance as an organ-building center really began after the eighteenth century. No single Baroque builder had the impact of a Schnitger or Silbermann there, although there were many important builders and dynasties. Another element of Bavarian organ building was the fact that Austria and Bavaria shared ideas and territory, and many important Bavarian instruments were built by Austrian builders (and vice versa). Southern Bavaria and northwestern Austria were often united geopolitically; linguistic, and other cultural similarities remain strong to this day.

In organ building, the stylistic influence of Bavaria's southern neighbors made itself felt from the late seventeenth century on. The "grandeur" of the high Baroque held its sway over much of Europe for several decades, producing such instruments as the "birthday cake" organ (see Bridgeman-Sutton), attributed to Andreas Jäger, at Wies/Erding (1757; rest. G. Schmid, 1959; now 3/42). But much of Bavaria moved swiftly into Rococo "decadence" at a time when tonal design and organ technology were at a relative standstill. The Rococo case featured cream colors and marbling (especially red) instead of bare wood; increased use of gold leaf; sentimental Italianate religious paintings filling the remaining empty spaces; and porcelain musician angels stood on top of, rested gargoyle-like upon, or even pushed pipes aside in individual chests.

During the nineteenth century, as political uncertainty was settling into German unification, Austrian builders were increasingly replaced by German builders inside and outside Bavaria; economic stability began to fuel the Bavarian organ-building trade, which prospered, thanks in part to an excellent supply of materials and the successful revival of Catholicism. World War I and the subsequent economic downturn did surprisingly little to hurt the Bavarian trade; the events of the 1930s and '40s were more devastating, but many builders survived and continued after the war. The recent decline in Bavarian organ building is attributable to factors found elsewhere: decreased church membership, economic strain, and (as a Catholic area) the effects of Vatican II and challenges within the church provided by Hans Kung and other theologians.

Over the centuries, Bavarian builders were most numerous in the southern regions of Swabia (particularly in the Augsburg, Donau-Ries, Oberallgäu, and Unterallgäu *Landkreise*, or districts), Upper Bavaria (Mühldorf am Inn, Munich), and Lower Bavaria (Deggendorf, Landshut, Passau, Straubing). The smaller central regions had correspondingly fewer builders—Middle Franconia (Ansbach, Nürnberg) and the Upper Palatinate (Regensburg)—but the northern regions of Lower Franconia (Bad Kissingen, Würzburg) and Upper Franconia (Bamberg, Hof) had a more active organ-building trade. Internal geography was a factor, with the Franconian Jura (Alps) dominating the topography of central Bavaria. In other cases, population and politics determined the whereabouts of builders. Besides the case of Munich, Bavaria's capital and largest city (in which half of Upper Bavaria's builders worked), there were Lower Franconia's border with Hesse, particularly that state's populous Frankfurt am Main area; Swabia's border with Baden-Württemberg, which has its own "Alps" and dense forests (supplying organ-building materials); and Upper Bavaria's fluid border with the Voralberg, Tirol, and Salzburg areas of Austria, with the corresponding flow of trade between the regions.

For centuries, those who emigrated to major German cities had to secure the *Bürgerrecht* (citizenship) to live in and practice their trade within that city. The first important builder for whom there is substantial documentation is Caspar Sturm (ca. 1540–after 1599), who moved to Regensburg as a church organist, became a builder, then joined the Munich court chapel of Duke Albrecht V (1568–1577); he relocated to Ulm in 1577 and died in Regensburg. He built organs in Munich, Stetten, Indersdorf, Scheyern (Benedictine monastery, 1575, 3/19), Isareck bei Moosburg, Rottenbuch, Abensberg, Ulm Cathedral (1576–78), and Weltenburg (1597). Anton Neuknecht (fl. 1581–1608), a citizen of Landshut, later moved his workshop to Munich (1586), but had left by 1592. He built instruments in Austria—Hall (Tirol), Innsbruck, and Stams—but most of his activity was in Germany: Munich, Trausnitz bei Landshut, Benediktbeuern, Eggenfelden, Wasserburg (St. Jakob, 1581), Rain am Lech, Ravensburg, and Strasbourg (Notre Dame, reb. 1491 Krebs organ, 1608; reb. A. Silbermann, 1713–16). Urban Heusler (fl. 1584–1617) worked in Munich; in part with Leonhard Kurz (1595–1612); works include Erding (St. Johann), Munich (St. Michael, 1597), Fürstenzell bei Passau, Munich (Holy Spirit), Andechs (Benedictine monastery, 1608), Eggenfelden (Stadtpfarrkirche), and Haidhausen.

Hans Lechner (d. 1634) was born in Irlbach bei Straubing; he was an experienced builder when he came to Munich in 1617, the year he became a citizen and took over Heusler's workshop. Lechner was Upper Bavaria's most important seventeenth-century builder; his works include several in Munich: the court chapel at the "Residenz"; "Old" St. Peter (ca. 1620); Evangelical Paulaner Gemeinde; Notre Dame (now Cathedral; 1628–31; destr. 1944); and Frauenkirche (1631). He also built organs at Tegernsee (Benedictine monastery); Landshut (St. Jodok, 1625); Regensburg ("Kurfürstentag," associated with the Diet of Regensburg, 1630), and Thalkirchen (St. Maria, 1630 [attrib]; now in Munich, Deutsches Museum; proto-Rococo case elements). Other Munich-based builders were Hans Mehrer (d. after 1669), who came from Würzburg and received citizenship in 1635 and repaired instruments damaged by invading Swedish armies, also working on organs in Thalkirchen, Dachau, Haidhausen, Ramersdorf, Munich ("Old" St. Peter, based on Lechner organ, 1648), and Munich, Holy Spirit (1669). Adam Fundensin (d. 1707) was a Silesian who apprenticed in Ingolstadt (Upper Bavaria) and married the widow of Munich builder Michael Martin (Freising, Franciscan monastery, 1662), taking over his workshop. He built instruments for Munich-Schwabing (St. Ursula), Tergerensee, Wartenberg, Weyarn (monastery, 1692; reb. Weber, 1745), Seligenthal bei Landshut (monastery, ca. 1702; now Beutelhausen bei Landshut), Paindlkofen, and Beutelhausen. Joseph Gloner (fl. 1708–ca. 1735) of Tölz bought Fundensin's workshop (1708) and installed organs at Munich (Holy Spirit Hospital), Gauting, Vilsheim bei Landshut, and Grünsink bei Wessling (Wallfahrtskirche, ca. 1730; rest. Kubak). Ignaz Philipp Hillenbrand (1710–44), from Würzburg and son of a builder, became a Munich citizen in 1738; during his short career, he built organs in Freising (Franciscan monastery), Lilienberg/Munich (monastery), Haag bei Wasserburg, Bernried, Munich ("Old" St. Peter, 1740; 2/26), Gars am Inn (Redemptorist monastery), and Grossholzhausen.

Two builders dominated Upper Bavarian organ building in the eighteenth century. Quirin Weber (1693–1751) was based in Dachau; he built instruments at Oberammergau, Munich, Ettal, Neustift bei Freising (ca. 1765 [attrib], with a mature Rococo case), Inhausen (ca. 1735); Heimhausen (palace chapel, 1736), Tölz, Tegernsee (monastery, choir organ, 1738; now Grosskarolinenfeld bei Bad Aibling); Maria Kappel bei Mering, Neustift bei Freising, Niedereviehbach, Inhausen, Vierkirchen (ca. 1740), Steingaden, and Weyarn (monastery, reb. of 1692 Fundensin organ, 1745, 2/20). The Franconian Anton Bayr (1716–92; Munich citizenship 1745) was the last great Munich builder before secularization ("profanation"); among his thirty-seven known instruments were those at Binabiburg (St. Salvator, 1747), Tading (1750, 1/5/pull-down, now Reithofen bei Erding), Rosenheim (Holy Spirit), Schäftlarn (Benedictine monastery, ca. 1762; 2/21, incorp. Vleugels organ, 1996), Ebersberg, (former monastery, 1763, 2/16; case survives), Wasserburg (St. Jakob, 1764, 2/27), Marienberg bei Raitenhaslach (1769), Mallersdorf (Benedictine monastery, 1783, 2/28; case survives), Attel am Inn (Church of Sorrows, ca, 1785,; case survives at Schwindkirchen), and Beyharting (1790; "early classical" case with less marbling and no porcelain statues).

The most significant organ-building dynasty to emerge from "Old Bavaria" was the EGEDACHER family, active in the seventeenth and eighteenth centuries in several cities. (Joseph) Christoph Egedacher II moved from Straubing, Germany, to Munich, then to Salzburg; he concentrated on building organs in that region until his death. Four sons took up organ building; the most notable were Johann Christoph Egedacher, who emigrated with his father and took over his Salzburg workshop in 1706, and Johann Ignaz Egedacher, who took over the Passau workshop of his father-in-law Leopold Freundt in 1727 in partnership with another brother, Johann Georg Egedacher, although he continued building in Austria. In Passau they trained their nephew, Johann Rochus Egedacher (Johann Christoph's son), who returned to Salzburg to work with his father and take over his workshop. Christoph II built organs in Germany (Benediktbeuern, St. Benedikt, 1682–86; reb. A. Jäger, 1771) and Salzburg (Cajetanian church, 1796; rest. Rieger; Cathedral, 1702–06, with Christoph III; case incorp. Metzler organ, 1984). Johann Christoph built instruments for churches in Upper Austria as well as Herrenchiemsee/Bavaria, Cathedral (ca. 1740; 2/19). Johann Ignaz, probably the most successful in the family, built organs in Austria: Neufelden, ca. 1728 (reconstr. Edskes, 1997), Zwettl, Cistercian church, 1728–31 (3/36; rest. Hradetzky, 1983), and Hartkirchen, 1736 (rest. Rieger, 1978). His relocation to Passau in the late 1720s has focused attention on his German works, including several in Passau (Cathedral, Lambergkapelle, 1737; rest. Eisenbarth, 1954). Johann Rochus worked primarily in Austria: Salzburg (St. Michael, 1770; Brüstungspositiv; rest.), its environs, the Tirol, and Styria; he built at least one organ in Upper Bavaria (Tittmoning, 1779).

The König family of Ingolstadt saw four generations: Johann (1635–1691; Freising, St. Georg, 1688) and his two sons, Caspar (1675–1739) and Balthasar (1684–1756); Johann Franz Michael, Caspar's son and successor (1723–1791); and three sons of Balthasar, notably Ludwig (1717–89). Caspar built mostly smaller instruments, including Freising (1712); Kösching (1725; case survives in Rottendorf); Klenau (ca. 1730); Niederaltaich (1727, 2/27); Appertshofen (ca. 1735, extant); and Diessen an Ammersee (1739, 2/25; reb.). Balthasar moved to the lower Rhine in order not to compete with his brother, and was influenced by French builders of the period. He worked in Münstereifel near Cologne (citizenship 1716) and, after 1735, the city itself, where he was the major builder of his time. Important instruments survive at Zeltingen-Rachtig, Beilstein an der Mosel, Niedrehe, and Steinkirchen (Upper Bavaria), former Premonstratensian monastery, 1720–27 (rest. Weimbs, 1977–81; now 3/35). Ludwig built organs for the Netherlands (Nijmegen, 1776) and Belgium (Alden Biesen, 1787–88).

Other organ-building families played major roles in eighteenth- and nineteenth-century southern Bavaria. Johann Fux and his son Johann Andreas Fux worked in Donauwörth (Swabia). The Frosch family of builders was started by Franz Frosch (1747–after 1825), who worked in Munich and, for a short time, Switzerland; he built an organ using a Georg Andreas VOGLER design at Munich, St. Peter (1806–09; 5/29). Three more generations of Frosch builders followed; all remained in Munich, built one- and two-manual organs, and maintained small workshops, up to the last (Franz Xaver Frosch, 1838–1909). The Maerz family began inauspiciously; Konrad (1768–1846) came from the Upper Palatinate, but only set up a small repair and maintenance workshop. His son Max Maerz (1814–78) was more successful; his workshop (started after 1842) built 130 smaller instruments, notably Johannrettenbach, St. Maximilian (1844, extant), Kraiburg am Inn (1848, extant), Steinkirchen an der Inn (ca. 1862, extant), Weilheim, Stadtpfarrkirche (1864 2/31, his largest), Sigmertshausen (1867, extant), and Schlehdorf am Kochelsee, St. Tertulin (1877, reb. of 1783 Thoma organ; rest. Führer, 1997–2000; 2/18). His adopted son Franz Borgias Maerz (1848–1909), an exponent of pneumatic actions, built over 450 instruments. Franz Borgias built three-manual instruments for Munich churches: St. Michael (1897), St. Benno (1898), St. Joseph (1902), St. Max (1903), and St. Paul (1908). Other organs include Straubing, St. Jacob (1898), Bad Reichenhall, St. Zeno (1899; rest. Späth 1998), and Augsburg, Cathedral (1904). The Ehrlich family was active in Passau, Straubing, and Landshut during the first half of the nineteenth century. The most prominent members were Ludwig II (Landshut, 1775–1844), Adam (Passau, 1777–1848), Anton (Straubing, 1814–81); and Johann (Landshut, 1819–60).

Other organbuilders of importance have been located in Upper Bavaria: Joseph Wagner, Müller family (all nineteenth century), Schmid family (nineteenth–twentieth centuries), Willibald Siemann, Albert Moser, Georg Glatzl, Ludwig Wastlhuber, and Julius Zwirner (twentieth century); Lower Bavaria: Franz Mitterreit(h)er (eighteenth century), Schweinacher and Plersch families (eighteenth–nineteenth centuries), Johann Rödl, Hechenberger family (nineteenth century), and Friedrich Meier (twentieth century); Swabia: Marx Günzer (sixteenth–seventeenth cebturies), Johann Andreas Stein (eighteenth century), Pröbstl family, Joseph Bohl, Mühlbauer family, Julius Schwarzbaur (nineteenth century), and the Hindelang and Koulen families (nineteenth–twentieth centuries); Upper Palatinate: Johann Sebastian Wild(e), Johann Konrad Vogel (seventeenth–eighteenth centuries), Johann Konrad Brandenstein, Johann Nepomuk Mälzel (eighteenth century; father of metronome inventor), Weiss family (eighteenth–nineteenth centuries), Binder firm (nineteenth century), and Hirnschrodt firm (twentieth century); Middle Franconia: Burkhard Dinstlinger (fifteenth century; very active in Austria), Wiegleb family (seventeenth–eighteenth centuries), Adam Ernst Reichard (eighteenth century), Johann Michael Bittner (nineteenth century), Strebel firm (nineteenth–twentieth centuries), and Erich Bauer (twentieth century); Upper Franconia: Timothy Compenius (sixteenth century; founder of Saxon-Thuringian organ-building dynasty), Matthias Tretzscher (seventeenth century), Schöpf family, Daniel Streit (seventeenth–eighteenth centuries), Graichen firm, Daum family (eighteenth century), Heidenreich and Hofmann families (eighteenth–nineteenth centuries), Karl Ernst Ludwig Weineck (nineteenth century), and Wolf firm (nineteenth–twentieth centuries); and Lower Franconia: Johann Konrad Kitzinger (seventeenth century), Adam Brandenstein, Will family (seventeenth–eighteenth centuries), Voit family (eighteenth century), Zahn and SEUFFERT families (eighteenth–nineteenth centuries), Bruno Müller, Schlimbach firm (nineteenth century), Markert firm, Eduard Hofmann (nineteenth–twentieth centuries), and Otto firm (twentieth century). Outsiders active in Bavaria included Jörg Falb (fifteenth century), Nicolaus Monsamer (sixteenth–seventeenth centuries), Johann Georg Faber (sventeenth century), Gruber family (seventeenth–eighteenth centuries), Allgeyer family (eighteenth–nineteenth centuries), and two Austrians, Sebastian Achamer and Paul Rotenburger (both sventeenth century).

Post–eighteenth-century Bavarian firms include: Bittner, Weise, Albiez, STEINMEYER, Hey Orgelbau, and Hoffmann (nineteenth century); and Joseph Zeilhumber, Offner, SANDTNER, Gerhard Schmid, Rudolf Kubak, Deininger and Renner, Weiss, Franz Schreier, Schuster, Anton Staller, Alois Wölfl, WRK-Orgelbau, Wilhelm Stöberl, Riegner and Friedrich, Jann, Ekkehard Simon, Ludwig Eisenbarth, Nenninger, Hans Karl, Georg Weishaupt, and Hilse. More recent builders from outside Bavaria have included LAUKHUFF, VLEUGELS, RIEGER, and E. F. WALCKER (all nineteenth–twentieth centuries) and Fischer and Krämer, Franz Heissler, Rudolf von BECKERATH, KLAIS, and MATHIS.

Bavarian organs have had three main advocates in recent years: Georg Brenninger (books on "Old Bavaria" and Swabia), and the team of Hermann Fischer and Theodor Wohnhaas (books on each of the Franconias and Swabia). In addition, Fischer and Wohnhaas have published a "lexicon of south German organbuilders." Brenninger, Fischer, Wohnhaas, and many others have had the opportunity to publish in local journals such as *Musik in Bayern* (which features regular columns on newly built organs), *Jahrbuch für Fränkische Landesforschung*, *Mitteilungen des Vereins für Geschichte der Stadt Nürnberg*, *Historischer Verein Bamberg: Berichte*, *Alt Füssen*, and *Historischer Verein für Mittelfranken.* Documentation of Bavarian instruments entered the Digital Age with the *Orgeldatenbank Bayern* (1980). Finally, Bavaria has a number of collections that include or focus on the organ, such as those in Ostheim von der Rhön and the Altes Schloss region. Two larger museums include sections devoted to instruments: the Deutsches Museum in Munich and the Germanisches Nationalmuseum in Nürnberg.

See also **Austria**

RICHARD KASSEL

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BEACH, GILES (1826–1906)

American organbuilder. Beach, born in Johnstown, New York, on 29 May 1826, took his apprenticeship with Augustus Backus, an organbuilder in nearby Troy (1844). In 1853, Beach returned to Johnstown (part of which later became Gloversville), and by the 1870s was employing some fifteen men. In 1870, he built a four-story factory, the American Church Organ Works. The building was destroyed by fire on 30 September 1876, and he was inadequately insured. Following the fire, he concentrated on tuning and repairs rather than building new instruments.

Beach's largest organs were built in New York: Cohoes, Reformed; Saratoga Springs, Methodist; Waterford, Presbyterian; and Schaghticoke, Reformed (his largest extant instrument). His work is characterized by fine workmanship and competent voicing, and the bulk of his clientele was located in New York's Mohawk River Valley. At least one of his sons, Arthur D. Beach (1869–1936), was also involved in organ work.

Beach is primarily remembered today for relocating the 1847 Davis and Ferris organ from Calvary Episcopal, New York City, to the Round Lake Auditorium, New York, in 1888. The nearly intact instrument, the largest and oldest three-manual organ in North America, has been maintained since the late 1960s. Beach, who also made violins, died in Gloversville on 9 September 1906.

STEPHEN L. PINEL

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BEARD

In flue pipes, a small metal rod (plate) or wooden dowel placed in front of and below the mouth, then fastened permanently between each EAR; if attached to the lower part of the ears, it is called a BOXBEARD; some are adjustable and curved (roller-beard). Narrow (small-scale) string pipes have a relatively large mouth, compared to their diameters; the beard helps focus the windstream on the upper lip, thereby improving the fuzzy, unstable attack that would otherwise result. This approach may also help produce a steady sound on larger flue pipes with large mouths. Finally, the beard may assist voicing and tuning. The Englishman William Thynne is credited with developing the roller-beard in conjunction with string voicing in the 1880s. The beard is sometimes called a harmonic bridge.

RICHARD KASSEL

BEARD, GEORGE A. WALES

SEE HILL, NORMAN AND BEARD; NORMAN AND BEARD

BEATS

SEE TUNING AND TEMPERAMENT

BECK

German family of organbuilders active in the Halle region from the latter half of the sixteenth century onward. Particularly prominent members of the family were Esaias Beck (d. 1587) and David Beck (fl. 1587–1601), who exerted a strong influence on the development of the Central German Baroque organ. Michael PRAETORIUS (1619) provides the disposition for the then recently built David Beck organ for the court chapel at Groningen, Netherlands (1592–96; 2[+ Rückpositiv]/57; reb. Christoph Contius, 1704; case preserved at Halberstadt, Martinskirche since 1770). The large number of stops on this late Renaissance organ is counterpointed by the presence of only two manuals on the main organ—the Rückpositiv is still separate—but there are other interesting aspects to this instrument. There are ten flute and chorus stops on an upper chest, ten reeds and solo stops in two side-towers, and six small Regal or high-pitched stops on two subsidiary Brustwerk chests. The Pedal division is divided into three subdivisions: the Oberlade ("upper chest," the Oberwerk; here, the Hauptwerk), side pedal towers, and "side Brustwerk." Metal pipes are used exclusively; Beck makes use of a *Sperrventil* ("blocking valve"), which regulates the flow of air into an entire chest or division. The David Beck organ at Groningen demonstrates the prototypical northern builder's pleasure in colorful and bold sounds, given the high ratio of reed stops when compared to the flue foundations. A century later, Andreas WERCKMEISTER (*Organum Gruningense*) commented on mechanical problems in the instrument.

Another organ builder, Johann Caspar Beck (b. Herrenbreitungen an der Werra, Apr 1703; d. there, 25 June 1774), was active in the eighteenth century and most of his work was in the Kassel area and in Thuringia. (There may be no relationship to the earlier Becks.) He worked with Johann Michael WAGNER and others on an organ for Laubach, Stadtpfarrkirche (1747). He contracted for other organs between 1733 and 1758–59, including: Herrenbreitungen (1733); Zella-Mehlis, Magdalenenkirche (1743); Wommen (1742–44); Wallbach (1748); Seligenthal/Schmalkalden (ca. 1750); Dermbach, Evangelischekirche (1754–55); and Schweina bei Bad Salzungen (1758–59). In 1769 he withdrew from a contract for the repair of an organ at Kassel, Brüderkirche.

According to the 1747 contract, the Laubach organ had the following specification: Hauptmanual: Principal 8', Quintathoen 16', Viola da Gamba 8', Flöte Travers 8', Octave 4', Gedeckt 8', Sesquialter II, Rohrflöte 4', Mixtur V, and Trompete 8'; Nebenmanual: Principal 4', Flöte 4', Musikalisch Gedeckt 8', Quintathoen 8', Octav 2', and Cymbale III; Pedal: Principal Bass 16', Sub-Bass 16', Viola 16', Octav-Bass 8', and Posaunen 16'.

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BECKER

German organ-building family and firm. Klaus Becker (b. Baden-Baden, 15 Feb 1924) began training in organ building in 1947 and apprenticed with Rudolf von BECKERATH in Hamburg until 1955, when he established his own workshop in Kupfermühle/Holstein, near Hamburg. Consistent with the approach used by classical builders, his instruments featured solid wood construction, mechanical trackers and stop action, and tone-channel chests. The company was very successful and built instruments not only for northern Germany but exported instruments to Sweden, Denmark, Norway, Netherlands, and the United States (Ripon, WI; South Holland, IL; Fond du Lac, WI). His son, Michael Becker (b. Sattenfelde/Kupfermühle, 30 July 1953), studied classical music and apprenticed in his father's workshop. From 1973 on he spent ten years traveling through Hesse and Austria, working with several firms on many organ-building projects. He took over leadership of the Becker workshop in 1990. Since then the company has completed some thirty-three organs ranging from small positives to three-manual instruments with over forty stops. The firm continues to build in the classical tradition. Representative instruments include: Twistringen, St. Anna (1994; 3/42), Stadthagen (1996; 2/28), Rhode (1997; 1/10), Schöningen, St. Lorenz (1998, 2/35), Flensburg, St. Marien (1999; 2/23), Bielefeld-Gadderbaum, St. Stephanus (1999; 2/19); Oberwittighausen, St. Ägidius, (2000; 2/13); Bad Segeberg (2000; 2/17); and Hamburg-Lohbrügge, Ev. Gnadenkirche (2003; 2/13).

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BECKERATH, RUDOLF VON (1907–1976)

German organbuilder. Beckerath was born in Munich on 19 February 1907; his father, Willy von Beckerath, an artist, is best known for his painting of Johannes Brahms at the piano. The family's move to Hamburg soon after Rudolf's birth proved significant; he developed a strong interest in the organ, and was able to see the instruments in the ALTES LAND region across the Elbe River from Hamburg. He became a student of Hans Henny JAHNN, who persuaded Beckerath to undertake an apprenticeship in cabinet-making as a preparation for an organ-building career (1924–27). In 1928 he moved to Paris to work for Victor GONZALEZ; in 1930 he secured a position with the Theodor FROBENIUS firm in Denmark, where tracker organs were being built. The economic depression forced Frobenius to terminate Beckerath's employment soon thereafter; he returned to Paris and was rehired at the Gonzalez shop. He remained there until 1936, working chiefly with Fernand Gonzalez.

In 1936 Beckerath returned to Hamburg and secured a contract to build a three-manual organ for the church in Othmarschen/Hamburg. The organ was built with tracker action, slider-chests, an enclosed case, a RÜCKPOSITIV, and an OBERWERK. In 1937, he restored the 1642 Tobias Brunner organ in Tellingstedt, north of Hamburg. Beckerath was able to retain the original pipework, making only those changes needed to restore the original concept of the organ. In 1938 he was hired by the Reichsministry for Church Affairs in Berlin, where he moved the following year. He cataloged historic organs in northern Germany, recording scalings, metal content, cut-ups, and other measurements. In 1941 he was given the contract to restore the organ in the Elizabethkirche in Breslau (now Wrocl[sl]aw, Poland). But he was drafted into the army, served, and became a prisoner of war.

After the war Beckerath re-created the catalog of northern historic organs, as all of his earlier research had been lost in the bombing of Berlin. Then the pastor of the church in Steinkirchen, near Hamburg, commissioned him to restore the very important Arp SCHNITGER organ there. The success of this restoration, which gained for him an international reputation, allowed him to set up Beckerath Orgelbau in 1949. Beckerath's success was assured through a contract for the organ in the Hamburg Musikhalle in 1950 (4/59). Since that time the Beckerath firm has built over two hundred organs in Australia, Austria, Canada, England, France, Germany, India, Poland, South Africa, the United States, and Yugoslavia. Some important Beckerath organs are at Düsseldorf, Johanniskirche; Cleveland, Ohio, Trinity Lutheran; Montreal, Oratoire-du-Mont Royal; Pittsburgh, St. Paul's Cathedral; and the Great Hall of the University of Sydney. He died in Hamburg on 20 November 1976; the Beckerath firm continues to operate.

Beckerath was a man far ahead of his time, remembered as an especially fine builder of contemporary organs combining historic principles of design and construction with some modern technical features. He was also an excellent restorer of historic instruments who respected to the highest degree the concepts of the original builders.

ARTHUR CARKEEK

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BEDIENT, GENE R. (B. 1944)

American organbuilder. A native of Hemingford, Nebraska, Bedient founded the Bedient Pipe Organ Company in 1969. By the end of 2002 the company had built seventy-two instruments. At the company's shop in Roca, Nebraska, its twelve employees custom-design and build all parts of the pipe organs from raw materials.

Bedient has made creative use of an unusually wide variety of organ-building styles dating from the sixteenth through the early twentieth centuries. While some of his organs follow a single historical tradition, others reflect an eclectic approach. Examples include: Lincoln, Nebraska, Wesley Chapel (1976; 2/20), based on sixteenth- and seventeenth-century northern European organs; Lincoln, St.-Mark's-on-the-Campus (1980; 2/9), a mixture of Italian Renaissance and Baroque with North German Baroque; Denton, University of North

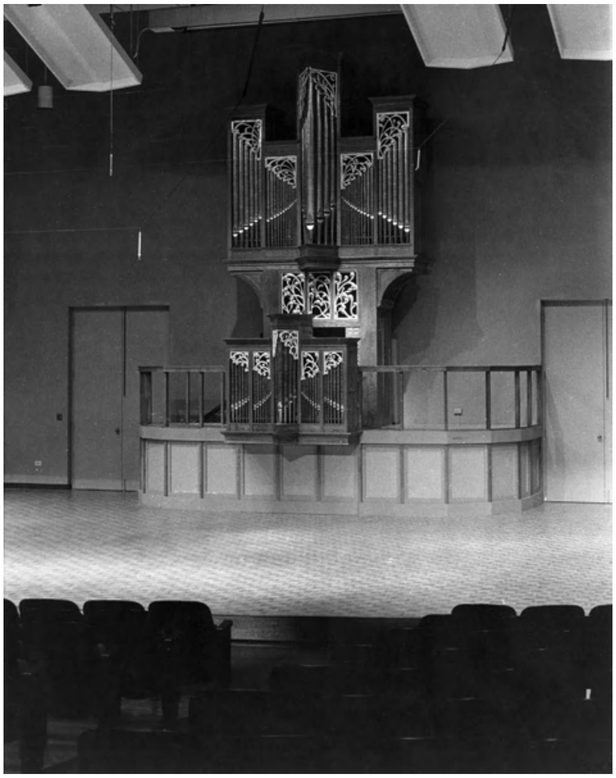

Fig. 16. Bedient organ (4/40), Ripon (Wisconsin) College.

Texas (1985; 4/40), in the eighteenth-century French classical style; Charleston, South Carolina, Cathedral of St. John the Baptist (1987; 2/27), patterned after Aristide CAVAILLÉ-COLL; and Lincoln, St. Paul United Methodist (2001; 3/47), an especially unorthodox instrument influenced by ideas from eighteenth-century Germany, eighteenth- and nineteenth-century France, and twentieth-century America.

With Jesse E. Eschbach, Bedient is cofounder of the Summer Institute for French Organ Studies, an advanced summer program in France that includes access to unaltered instruments by CLIQUOT and Cavaillé-Coll. He is also on the faculty of the School of Music, University of Nebraska–Lincoln.

GEORGE RITCHIE

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BÉDOS DE CELLES, (DOM) FRANÇOIS (1709–1779)

French organbuilder and theoretician, author of *L'art du facteur d'orgues* (The Art of the Organbuilder, 1766–78), the highly influential treatise on organ building. Bédos de Celles was born to aristocratic parents in Caux, near Béziers, on 24 January 1709. Of his early life and how Bédos de Celles learned the craft of organ building, little is known. In 1726 he entered the Benedictine order at Saint-Maur in Toulouse. Bédos de Celles lived in several abbeys and monasteries throughout France, moving to Paris for the last 20 years of his life; he died at the abbey of St. Denis on 25 November 1779.

Six organs are known to have been built by Bédos de Celles (two or three additional organs are attributed to him), all dating from the period between 1748 and 1760. Parts of three remain, notably the instrument in Bordeaux, Sainte-Croix (1748; reconstr. P. Quoirin, 1996). Bédos de Celles knew the leading French organbuilders of his day, including Jean-Esprit ISNARD, Pierre DALLERY, Jean-Baptiste Nicolas LEFÈVRE, and members of the L'EPINE, Cliquot, and CAVAILLÉ-COLL families. He was in demand as an expert, not only to test new organs, but to draw up detailed plans or to approve designs for organs to be built by others. His report on the organ of Saint-Martin at Tours, completed by Lefèvre in 1761, was published twice in France and appeared in a German translation in Jacob ADLUNG's *Musica mechanica organoedi* (Berlin, 1768). Joseph GABLER, whose Weingarten organ Bédos de Celles visited, and Karl Joseph RIEPP were two organbuilders outside France whom the Frenchman knew. Bédos de Celles was also a skilled mathematician, and his book on sundials, *La gnomonique pratique,* appeared in 1760. He was a corresponding member of the Academy of Science in both Bordeaux (1759) and Paris (1767).

Bédos de Celles's treatise owes its existence to the *Description des arts et métiers* (Description of Arts and Crafts), an ambitious series of books produced in Paris by the French Royal Academy of Sciences between 1761 and 1788. *L'art du facteur d'orgues* was the only book on a musical subject in the series. Bédos de Celles received the commission to write a treatise on organ building for the academy as early as 1760. (The claim that one Dom Monniot wrote *L'art du facteur d'orgues* under Bédos's direction has been disproved.) The first of a projected three parts was published in 1766 (distributed in early 1767); the second and third parts appeared in 1770. Part 1 discusses the mechanics of organ building, essentials of joinery, tools used in organ building, organ stops with their dimensions and scales, and the parts of the organ. Part 2 has advice for architects and contains detailed information on windchests, stop and key actions, bellows, wooden pipes, how to cast pipe metal, pipe-making, voicing, temperament, and organ repair. Part 3 has twelve sample specifications of small to large organs and discusses organ testing, organ maintenance, and registration.

Bédos de Celles originally intended his treatise to be complete with these three parts, but the Academy suggested a fourth part to go beyond his treatment of the church organ. Part 4 was published in 1778 and begins with a historical introduction on the organ, in effect the preliminary matter to the entire treatise. Part 4 proper describes organs for auditoriums and private rooms, regals and table organs, barrel organs (including how to pin the barrel), and three claviorgan types (organ with pianoforte, harpsichord, and hurdy-gurdy). For the two chapters on the barrel organ, Bédos de Celles enlisted the help of Marie Dominique Joseph Engramelle, whose *La tonotechnie ou l'art de noter les cylindres* (Paris, 1775) appeared while his own work was in progress.

The success of *L'art du facteur d'orgues* comes from the authority of Bédos de Celles, the comprehensive nature of the treatise, the ability of the author to express himself clearly, and the physical opulence of a book in folio format with 137 carefully executed copper engravings. No point was too small to be considered and the tips Bédos de Celles gave could only have come from the workshop. He also had the advantage of describing an instrument and style that, though not completely static, had been refined for generations. Even if organs with a classical French specification were not being built in other countries during the eighteenth and nineteenth centuries, the influence of Bédos de Celles was felt in two ways. First, the treatise had a wide distribution, and there were numerous organbuilders in Spain, the Low Countries, and Germany, even in countries as distant as Poland and the United States, who knew and consulted the work. Second, *L'art du facteur d'orgues* had a profound impression on writers on the organ, and it may be safely said that every comprehensive work on organ building written since has been influenced by him, including: Johann Samuel Halle, *Die Kunst des Orgelbaues* (Brandenburg, 1779); Johann Christoph Vollbeding, *Kurzgefaßte Geschichte der Orgel* (Berlin, 1793); Jan van Heurn, *De orgelmaaker* (Dordrecht, 1804–05); Johann Gottlob Töpfer, *Lehrbuch der Orgelbaukunst* (Weimar, 1855); and Mariano Tafall y Miguel, *Arte completo del constructor de órganos* (Santiago [de Compostela], 1872–76). In France, Marie-Pierre Hamel's *Nouveau manuel complet du facteur d'orgues* (Paris, 1849) reprinted the first three parts of Bédos de Celles's treatise. Joseph Guédon's *Nouveau manuel* (Paris, 1903) reprinted almost all of Hamel-Bédos, updating the book to the early twentieth century. Outside France, the German Organ Reform Movement in the 1930s led to a reprint of the treatise; in the 1970s, with increasing interest in the classical French organ, English and German translations of *L'art du facteur d'orgues* appeared.

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BELGIUM

See Low Countries

BELL DIAPASON

See Flûte à Pavillon

BELLOWS

The apparatus that collects air and feeds it into a windtrunk, eventually reaching the windchest, where it is distributed to the organ pipes, making it possible for them to sound. A well-known early reference (ca. 1400) to the "organum" defines it as an instrument blown "with bellows." Direct human operation of bellows continued into the nineteenth century, when flowing water pressure (driven by streams or mains) was used where feasible, a system recalling the ancient hydraulis. Soon, steam engines and electric motors were driving the bellows; eventually all such methods were superseded by electrically driven blowers, successors to the nineteenth-century hand-cranked rotary fan. The original bellows concept held until fully electronic instruments developed in the latter twentieth century. Oddly, many post–World War II "authentic" instruments used electricity to serve the winding function.

Direct Beginnings

The earliest systems used water pressure motivated by human power to force air into the hydraulis and similar instruments, but toward the latter part of the first millennium CE, water pressure was replaced by cuneiform or similarly shaped pumps (feeder bellows) operated by hand (for smaller organs such as the PORTATIVE and POSITIVE). For bigger instruments, larger bellows were placed on the ground and expelled air when motivated by body weight. In either case, animal leather and a wooden frame and top were the primary elements.

In the latter part of the first millennium CE, the desire to put organs in churches, where the negative associations of the hydraulis with "pagan" Roman celebrations were too great, required the development of another way to wind the organ. The air would now be "pumped" into the windchest by direct manpower. The earliest winding devices were probably "blast bags," animal bladders that gathered and released air into the chest or intervening windtrunk. However, the short lifespan of the bags and very irregular pressure led builders to borrow the principle behind the bellows used to stoke fires and apply it to the organ, creating a type later known as the feeder or forge bellows, made of wood and leather.

In smaller instruments such as the positive, such bellows could be hand-operated by an assistant, as with a HOUSE ORGAN; but as organs grew in size and more complicated in construction, the organ's need for more air required a more powerful bellows. The eleventh-century writer THEOPHILUS (*De diversis artibus*, book 3) describes how organs were built in the past, including the mostly wooden, cuneiform (forge) feeder bellows, operated by the player's (or others') feet. These feeder bellows, with valves to keep air from leaking, fed a duct that led to the windchest. The writer includes copious instructions on how to "hide" the apparently noisy bellows from the listening audience. (A similar system was still being used in tracker organs as late as the seventeenth century.)

The Birth of Indirection

Direct systems of blowing air into an organ gave way to indirect systems. Larger feeder bellows ("wedge," "board," or "frog's mouth"; made of wood, leather, and metal bindings) were separate from the console. A hand lever was raised to fill the bellows with air, which was then expelled into the windtrunk by the weight of the operator (CALCANT) standing on a particular bellows, holding onto a horizontal bar for balance. By the sixteenth century human beings were being replaced by weights or ballast (stone or metal) to force the air by gravity into the windtrunk. As before, the larger the instrument, the greater number bellows were needed to maintain steady air flow.

During the sixteenth century, a more refined type of wedge or diagonal bellows (*Spanbalg*) was developed. Its frame rested on the ground, and the "wedge" rose from the front to its peak at the back. While the basic concept was unchanged (air fed in by lever, expelled by weight-assisted gravity), the addition of a hinged fold or folds to the leather collector, secured by wooden ribs, stabilized the flow of air as it entered the windtrunk.

There were at least two other indirect systems that pumped air into the windtrunk without additional storage space. Both used a pulley rope to fill the bellows with air; once raised, weighted gravity expelled the air much like WEDGE BELLOWS. The lantern bellows (seventeenth century) were named for their square shape. The box-bellows (seventeenth-nineteenth century) raised a box that fell within a second, slightly larger box; the two boxes produced an air chamber sufficiently airtight to function properly, thus avoiding the need for leather folds or hinges.

Parallel Rise, Reservoir Fall

The shape of the box-bellows may have led to the idea of a two-part bellows to improve wind stability even more. In the latter eighteenth century, the PARALLEL RESERVOIR and feeder bellows and magazine (Ger. *Magazin*, storage) emerged. The simple lever-operated bellows served as the base wind feeder to a reservoir, a rectangular chamber with one or more folds that stored the wind generated by the bellows, descending as air was expelled. An exhaust valve permitted the dispersal of excess air when necessary. The later "horizontal bellows" reduced the feeder to a lever-operated fold under the reservoir, scaffolded to permit the feeder to expand.

Essentially, the parallel reservoir and feeder bellows of the turn of the nineteenth century was the fulfillment of the purely mechanical bellows system. The feeder bellows, with its foot-operated pedals or treadles, continued to serve house organs and became the mechanism of choice for the new free REED ORGAN or harmonium. Subsequent developments focused on the source of the wind itself, with water mains, steam engines, and electric motors moving the bellows instead of physical labor. The rotary fan was a throwback in its use of human energy, but it provided steadier air than bellows and was more effective for wind supply challenges such as the sudden drawing on of multiple stops. The electrification of the rotary fan led to a device that, with improvements, provides wind to most organs today.

Romantic Refinements

A single-fold horizontal bellows could be combined with a reservoir to feed a particular group of pipes—for example, the free-reed Physharmonika, a harmonium-like stop, whose pipes were MOUNTED on a separate windchest. The dedicated reservoir is filled by a bellows that lies above and whose air is pressed downward by spring. In some cases, a separate foot pedal controls the reservoir pressure, permitting expression within the stop.

The BARKER LEVER was the first widely accepted pneumatic unit. Here, the pressured air from the main bellows moves into the lower half of a divided windchest, dedicated to a single key. When that key for that chest is activated, a palletlike valve is pulled down, causing the air to escape through to the upper half and from there to a duct that leads to a second, single-fold wedge bellows. The filling of the bellows pulls down a tracker that engages the pipechest pallet.

Small regulating devices called CONCUSSION BELLOWS (winkers) were sometimes placed near the windchests as a last opportunity in the windtrunk to prevent the wind from "shaking," causing unsteadiness of tone production. The cone-chest (*Kegellade*) involves a bellows that supplied wind to an entire rank when selected; this kind of chest is said to be "barless," lacking a note channel. Although the open rank is continuously winded, notes sound only when their key were activated, raising a group of cone-like valves that produce sound only in the winded ranks. In some cone-chests, the valves are more like small discs and are operated by bellows-like pneumatic motors.

TUBULAR ACTION relies on two pneumatic motors in step, both motivated by the presence or lack of air pressure at different points in the wind flow. The first (primary) motor is connected to the initial touch box or key pallet; the second(ary) motor, motivated by a valve from the first, in turn activates an old-fashioned sprung pallet within the windchest. When electricity was made part of the pneumatic process, electromagnets (solenoids) were used to move the valve that "feeds" the primary motor; again, the secondary motor functioned in a purely pneumatic way. There are two types of pneumatic actions: pressure-pneumatic and exhaust-pneumatic.

The VENTIL chest, a late nineteenth-century STOP CHANNEL chest (*Registerkanzellelade*), involves a simple frame supporting an airtight membrane (i.e., without folds or ribs); it, too, is operated by tubular-pneumatic actions. Each pipe's conduit has such a chest. As wind travels through an open rank, air pressure keeps the conduit closed via the membrane below to prevent its sounding. Pressing the key releases that air pressure; the membrane is now pushed down by the wind destined for the pipe, and that wind rises through the conduit to the pipe's foot.

Perhaps the most significant development was the implementation of hand-cranked rotary fans, or "rotary centrifugal air turbine blowers," later powered by steam, gas, or water power, and which in their electrified form would become the primary means of winding pipe organs.

Electric Experiments

The American brothers Frank and Hilborne L. ROOSEVELT introduced a number of new approaches to pneumatic and electro-pneumatic organs, and were pioneers in the development of purely electric instruments. While they are probably best known for their work with piston-set adjustable combination actions, the Roosevelts were skillful adapters of available technology. In one instrument (Great Barrington, MA, Congregational, 1883), the builders placed its complex "blowing apparatus" in a cellar room below the vestibule (shades of Theophilus!): three water motors (for winding and combination action pneumatics), horizontal feeders, large windtrunks and airshafts, bellows large and small, pneumatic actions, and REGULATORS, all leading to the organ's various departments.

The term *pallet* is often treated as a synonym for *valve*; their functions are identical—opening the conduit to the pipe foot so that air can enter under pressure and sound the associated note. The distinction is more in the design; while the pallet was generally a small rectangular slat of wood (motivated by stickers, springs, trackers, bars and, later, pneumatic motors), the nineteenth-century valve was usually a disclike object that opened and shut the conduit, often by a complicated series of pneumatic steps. ROBERT HOPE-JONES applied thin, low-voltage valve electromagnets to improve often clumsy and electricity-sapping pneumatic actions. In his unification system, all pipes had their own valve and magnet, allowing each pipe to be sounded by multiple key and stop actions. Perhaps most innovative (but expensive and difficult to maintain) was the variety of bellows (and therefore wind pressures) and windtrunks applied to distinct timbral departments (or "units," each in its own chamber), even ranks, in Hope-Jones's quest for a truly "orchestral" instrument, later known as the UNIT ORGAN.

The "electrified rotary centrifugal air turbine blower" became the most popular means of supplying wind in the twentieth century, thanks to its efficiency, relatively simple technology, and absence of physical labor. Electric blowers cannot expel excess air, however, and must be regulated even before the wind enters a reservoir; the relentless pressure would otherwise overblow the instrument into submission. The typical regulator is a box containing a set of vertical shades. As with the pulley-rope bellows of the eighteenth century, the level of the reservoir determines whether the shades are closed (by a full reservoir, with the pulley rope at its least taut) or, as the reservoir empties, the shades are gradually pulled up, allowing the right amount of air from the blower. The electric blower remains the standard means to wind pipe organs, excepting the most exacting, "authentically reproduced" NEOCLASSICAL ORGAN; even many of these offer both manual and electrically blown winding.

With the early twentieth-century application of RELAY AND SWITCH SYSTEMS to create electrically powered key and stop actions, and with the more recent emergence of solid-state electronics, the "need" for any winding mechanism disappeared in the latter twentieth century. But, to paraphrase Bertolt Brecht, "some things are missing": the sound of air being blown through pipes; the loss of subtleties of attack possible in tracker and other preelectric systems; and, ironically enough, the "unsteadiness of wind" that typified all instruments in the centuries before electricity and (especially) electronics. For many, not only is the absolutely steadiness of electrically controlled sound tiresome to the ear, but such sound lacks the human element of breathing that has always made acoustic (or merely amplified) instruments easier for listeners to identify with and enjoy.

See also **Action; Care and Maintenance of Pipe Organs; Water Motor**

RICHARD KASSEL

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BELLS

(1) A Glockenspiel with reiterating (repeating) action in the theater organ tradition.

(2) A family of organ stops. As a theater organ stop, Bells can be found in the Wurlitzer instruments at the Emery Theatre, Cincinnati; at Paramount Theatre, Oakland, California, and at the RKO Palace, Rochester, New York. Bell stops fall into several categories:

The Bell Clarinet is an imitative 8' manual solo reed that produces a brighter-than-average orchestral Clarinet tone. The widely flaring bells at the tops of the half-length (stopped) or unison-length cylindrical metal pipes permit an added cluster of very high but soft overtones to escape the pipes.

The Bell Diapason (also Flûte à Pavillon or Courcellina, honoring the voicer John Courcelle) was invented in France in the 1840s. The French builder Ducroquet introduced it into England at the 1851 London Exhibition. Its distinguishing feature is the flaring bell on the top of the pipe. These bells required extra work in pipe-making and additional space on the windchest, factors which led to its eventual decline in popularity. BISHOP and other English builders inappropriately renamed the stop Bell Diapason, as it is really an 8' Principal-Flute, or at least a Flute-Diapason hybrid. The pipes are cylindrical, similar to that of a Principal; the mouth is similar to a Diapason in width, but cut higher. The top is an inverted conical section. Its tone is full and rich, and the top bells impart some brightness. A variant of the Bell Diapason is the Bell Pipe, with a conical body and a reedier tone.

The Bell Flute (or Glockenflöte) is an open metal Flute of 4' or 8' manual pitch with a cylindrical metal body and a bell-shaped top. It has a sweet and clear, slightly horn-like timbre. The Bell Gamba (also Glockengamba) is a variant of the Gamba, found at 8' on the manuals or, occasionally, at 16' in the Pedal; it also has the characteristic bell-shaped top. There is dispute as to its body shape (conical or cylindrical) and its scale. The tone of the Bell Gamba has been described as delicate and reedlike, and similar to that of the orchestral Viola da Gamba. Like the Bell Diapason, the stop is largely obsolete, owing to difficulties in its construction, voicing, and regulation.

The Orchestral Bells is a tuned percussion stop consisting of metal bars struck by hammers, actuated by an electric or pneumatic mechanism. The Austin organ at St. John's Cathedral in Jacksonville, Florida, contains two kinds: Tower Bells (ten cast bells in a chime) and Bird Bells (twenty-five tubes with brass resonators).

TINA FRÜEHAUF

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BENDELER, JOHANN PHILIPP (1654–1709)

German music theorist, cantor, organbuilder, and organ expert. Bendeler was employed in Quendlinburg and was closely associated with Andreas WERCKMEISTER (see encomia by Bendeler in Werckmeister's *Hypomnemata musica*, 1697 and *Orgel-Probe*, 1698). Of Bendeler's nine known published treatises, seven are concerned with musical matters, and of these the 1690 *Organopoeia* is best known. A landmark work on the subject of pipe scaling (see Mahrenholz), the volume also includes important discussions of windchest design and temperament. Both temperament and the refurbishment of harpsichords are addressed in the 1689 second volume of Bendeler's *Aerarium Melopoeticum*. Although Georg Andreas Sorge (*Derin Rechen—und Messkunst wohlerfahrene Orgelbaumeister*, Lobenstein, 1773) states that Bendeler was the son-in-law of Arp Schnitger, this was not the case.

VINCENT J. PANETTA

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BERNATI-VERÍ, JORGE BOSCH

SEE BOSCH BERNATI-VERÍ, JORGE

BIAGI (BLASI), LUCA

SEE BLASI (BIAGI), LUCA

BIBLIOTHECA ORGANOLOGICA

A reprint and facsimile series, founded in 1962 by Frits Knuf (Hilversum, later Amsterdam), who also founded the *Organ Yearbook*; the series was taken over by Laaber-Verlag (Germany) in 1994. Peter Williams is general editor. The purpose of the series is to reprint "essential monographs in all fields of music" and make available "the scholarly production of universities and colleges" that nevertheless would be of interest to more than music historians. The more than eighty published volumes include writings on historical development, building and maintenance, and performance; among the authors are Carlos de Azevedo, JOHANN PHILIPP BENDELER, Girolamo Diruta, Karl Gustav Fellerer, Gerhardus HAVINGHA, Jan van HEURN, Arthur George Hill (grandson of William HILL), Hopkins and Rimbault, Johann Christian Kittel, SALOMON DE CAUS, Arnold Schering, Arnolt SCHLICK, and Daniel Gottlob Türk.

RICHARD KASSEL

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BIFARA

There are two stops with this name (also Bifra, Piffara, and Piffaro). The first type has two mouths, similar to the Doppelflöte, with one mouth set slightly higher than the other, so as to produce a Celeste effect. The wind supply is limited by a small bore. Unlike the Ludwigtone, this stop apparently has no inner dividing wall. Sources disagree as to whether it was made of wood or metal, though wood is more likely. It was made at both 8' and 4' pitch, and was popular in southern Germany and Austria from around 1600 on. No extant examples of this form of Bifara are known.

The other type of Bifara consists of an 8' stopped FLUTE combined with a soft 4' string, or sometimes 8' and 2' ranks, or 4' and 2' ranks. E. F. WALCKER reportedly applied the name to a pair of ranks at 8' and 4' or 8' and 2', tuned as a Celeste. In actual usage, up to seven unison- and octave-sounding ranks of different timbres have been combined. The earliest known examples of this form of the stop date from 1737.

See also **Stop**

EDWARD L. STAUFF

BIGELOW, MICHAEL L.

American organbuilder. Born on 7 December 1946, Bigelow graduated from the University of Utah in 1972, then served a four-year apprenticeship with John BROMBAUGH. After travel to visit European instruments convinced him to go the tracker route, he returned to establish M. L. Bigelow and Co. at Provo, Utah, in 1978, moving in 1984 to a larger shop in American Fork, Utah. In 1985 he was joined by David Chamberlin, who became tonal director and vice president.

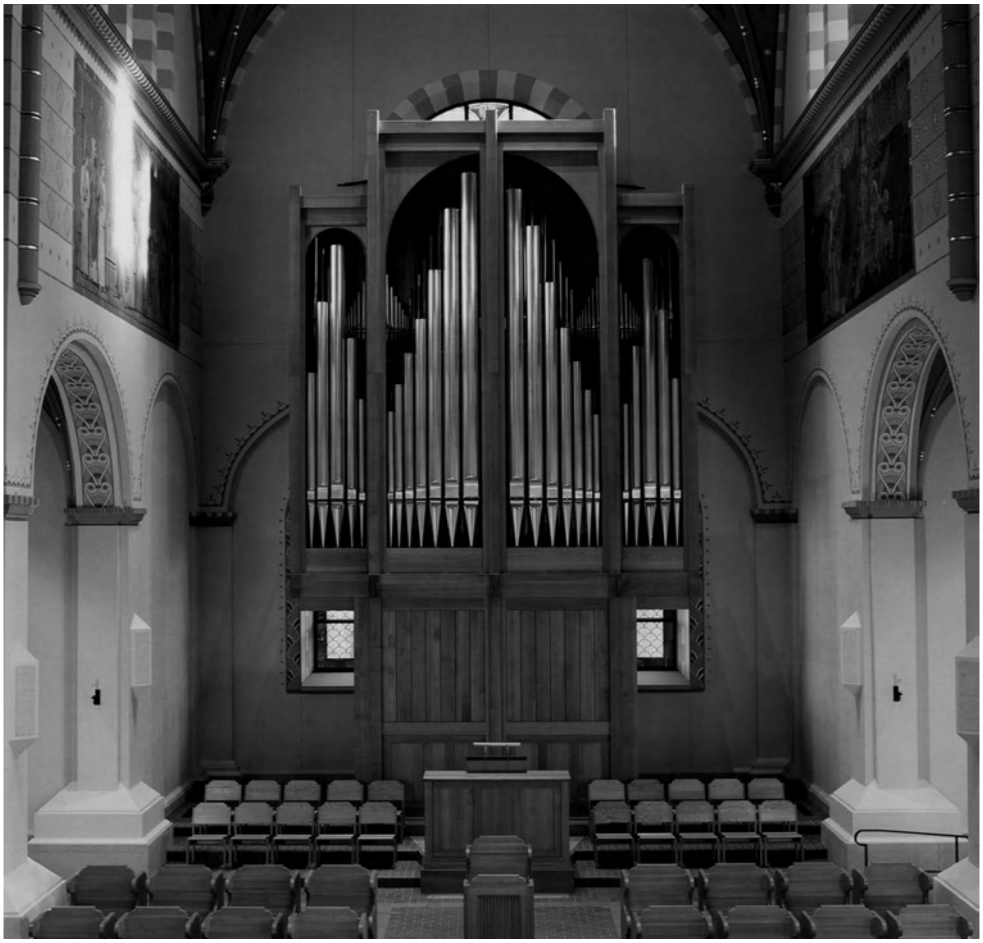

Fig. 17. M. L. Bigelow & Co. organ, op. 24 (3/40), Conception Abbey Basilica, Conception, Missouri.

The firm builds mechanical action organs based on the traditions of northern Europe, mostly having suspended key action. Its first organ was for Chico, California, St. John Catholic (1979; 2/13); an organ for Clarksville, Tennessee, First Presbyterian (2/30) is slated for completion in 2006. A feature of most of the company's output is the use of "Either/Or Registration," a system (fully compatible with tracker actions) that allows stops to be registered on either one manual or the other. Therefore, each stop control (recently replaced by a drawstop) has three positions: Manual I, Manual II, or off. This registrational flexibility is not a duplexing technique but is achieved by the use of a windchest having two tone channels per note and a slider-chest with two "on" positions.

Bigelow's largest instruments are at Victory Lutheran Church, Mesa, Arizona (Op. 17, III/57, 1988–93) and Conception Abbey Basilica, Conception, Missouri (Op. 24, III/40, 1999).

Arthur Lawrence

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M. L. Bigelow and Co. <http://www.mlbigelow.com/>.

BIGGS, E[DWARD GEORGE] POWER (1906–1977)

English-born American concert organist. Born in Westcliff-on-Sea, Essex, on 29 March 1906, Biggs studied at the Royal Academy of Music in London under G. D. Cunningham. He emigrated to the United States in 1930, where he began his career inauspiciously as a church organist in Newport, Rhode Island. In 1932 he moved to Cambridge, Massachusetts, where he spent the rest of his life. In the same year he married Colette Lionne, a concert pianist, from whom he was divorced in 1944; in 1945 he married Margaret Allen, who became a strong partner in the progression of his career.

Although Biggs held subsequent church positions in Cambridge and Brookline (Massachusetts), and taught from 1932 to 1951 at the Longy School of Music (Cambridge), the main focus of his career from the outset was concertizing and recording. Between 1939 and 1947 he recorded exclusively for Victor Red Seal; from 1947 on he made over one hundred recordings for Columbia Records. From his student days in London until less than a year before his death in Boston on 10 March 1977, Biggs played a phenomenal number of concerts throughout the United States and Europe, and he was much in demand as a performer with symphony orchestras. A unique aspect of Biggs's performing career was his weekly radio broadcast on the Columbia network, extending from 1942 to 1958. These broadcasts originated, with minor exceptions, from the Busch-Reisinger Museum at Harvard University, Cambridge, and featured a broad spectrum of music of all periods, both solo and concerted.

Biggs was a positive and influential force in the movements that were shaping the American organ during the middle decades of the twentieth century. An early supporter of avant-garde organbuilders such as G. DONALD HARRISON and Walter HOLTKAMP, he was in the forefront of the "American classic" movement of the 1930s to the 1950s. The organ in the Busch-Reisinger Museum with which Biggs made his broadcasts (as well as some early recordings) was an early neobaroque experiment designed by Harrison. After his early recording tours to Europe in the 1950s, Biggs espoused the cause of mechanical action and a closer identification with historic models, and in 1958 he imported a new D. A. FLENTROP organ for the museum (now known as Adolphus Busch Hall), on which he recorded extensively and which he later donated to Harvard. In 1964 he purchased a pedal harpsichord, using it for practice, concerts, and some rather unorthodox recordings (including music of Scott Joplin on pedal harpsichord). His recordings of historic European organs exerted a powerful influence on American tastes in the 1950s and 1960s, and in his later years Biggs became a champion of progressive American organbuilders such as Charles B. FISK.

BARBARA OWEN

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BIRD WHISTLE

A sound-effect stop that imitates the warbling of birds by immersing the ends of two or more small metal pipes in a vessel of water or light oil. Oil is preferred because it does not evaporate. It dates from at least as far back as 1450. Synonyms include Nachtigall, NIGHTINGALE, VOGELGESANG, Pájaros, Passarinhos, Rossignol, and Vogelgeschrei.

See also **Stop**

EDWARD L. STAUFF

BISHOP

English organ-building firm. James Chapman Bishop (ca. 1783–1854) founded his firm around 1807; it was known as Bishop and Starr (1854–57, 1861–73), Bishop, Starr and Richardson (1857–61), and Bishop and Son (from 1873 on).

Bishop was apprenticed to Benjamin Flight, whose business consisted mainly of making barrel and machine organs. He set up in business on his own account in London in around 1807, supplying parts and building chamber and barrel organs. By the 1820s his church trade had expanded, and he secured a number of major London contracts, including St. John, Waterloo Road (1824), All Souls, Langham Place (1825), and St. Paul's Cathedral (1826). In 1829 he built a twenty-eight-stop organ for St. James, Bermondsey, with a twenty-five-note Pedal with three stops (Double 16', Unison 8', Trombone 8') that could be played either with the feet or from a finger keyboard to the left of the Choir keys.

The Bermondsey organ included other innovative features pioneered by Bishop during the 1820s. The first documented use of the composition pedal is 1820. Bishop claimed its invention, although this was disputed by Flight and Robson. He made a number of other improvements to winding introduced during the 1820s. He also experimented with the use of a closed shallot for reeds (Bermondsey has three types), all used by Victorian organbuilders. A further (tonal) novelty, the Clarabella, an open wood Flute of melodic character, was apparently not on the Bermondsey stoplist, but was frequently used by Bishop after 1819.

His later organs were less innovative. Bishop was a reluctant convert to the German-style organs of the 1840s, and the C-compass organ with thirty-nine stops at St. Giles, Camberwell (1844), built in collaboration with S. S. Wesley, lacks conviction, bearing out an obituarist's observation that he entertained "certain prejudices . . . as to tone, which always interfered with his success in constructing a large organ."

On Bishop's death a partnership was formed between his son, Charles Augustus Bishop (b. 1821) and the firm's manager, John Starr; a third partner, William Ebenezar Richardson, joined in 1857 but withdrew four years later. When Starr retired in 1873, Charles K. K. Bishop (1850–81), author of *Notes on Church Organs* (London, 1873), became his father's partner. The firm built a number of significant instruments during the third quarter of the nineteenth century (Brompton, Oratory, 1857; Nottingham, St. Mary, 1871; Bombay, Town Hall, 1873), but the business came into difficulties and was acquired in 1880 by Edward Hadlow Suggate (1852–1946). The firm is still in existence with premises in London and Ipswich; it was responsible for the reconstruction of the Thamer organ at Framlingham (1970) and the new organ for Lancaster University (1979).

NICHOLAS J. THISTLETHWAITE

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BLANGZ

SEE SUISSE, HANS

BLASI (BIAGI), LUCA (CA. 1545–1608)

Italian organbuilder. Luca Blasi was born in Perugia; his brother, Stefano, was also an organbuilder. Luca's first organ was built for S. Maria Nuova, Perugia (1585; repl. 1960), an organ particularly known for its stunning facade. By 1595 Blasi had moved to Rome where, after constructing the organ at the Frascati Cathedral, he opened his own organ workshop. There Blasi secured work from the organist Zucchelli, building the organs at S. Lorenzo Damaso and the Cappella Gregoriana in St. Peter's.

However, Blasi is most revered for his organ at S. Giovanni in Laterano, Rome (1599; inaugurated 1600), commissioned by Clement VIII. In addition to a sixty-six-channel spring-chest, the original organ consisted of one manual (a second manual was added in the eighteenth century) with a compass of F', G', A'-f'' and fifteen stops, a Principale Profondo 24', Principale Ottava 12', Flauto in VIII, Flauto in XV, Decimaquinta 6', Decimanona 4', Vigesimaseconda 3', Vigesimasesta, Vigesemasesta II, and Zampogne-Trombe 12'. The organ also had seven split keys, six bellows, a tremulant, and probably a pull-down pedal. Barthélémy Formentelli restored the organ between 1987 and 1989.

Blasi secured further success with his water organ in Rome's Quirinale gardens (1598), a work that guaranteed the organbuilder a twenty-year privilege by Clement VIII. Between 1603 and 1608 he worked on a number of projects, including the completion of a two-manual organ for S. Maria in Aracoeli, Rome (actually built by Benvenuti and Palmieri), and the organ of SS Annunziata, Sulmona (1604). In 1605 he was the Custode de Montecavallo, the keeper of the organ at Quirinale. For much of his life, Blasi was also in demand for his skills in organ restoration. He maintained the organ at Rome, S. Giovanni in Laterano until his death in that city.

THOMAS CIMARUSTI

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BLOCK

SEE BOOT; FLUE; SHALLOT

BLOCKFLÖTE

A large-scale FLUTE stop of 8', 4', 2' or 1' pitch, named after the instrument (recorder) and sometimes imitative of it. It is usually open metal, but sometimes of wood, and may be stopped, conical, or even harmonic (double-length). It is most often found at 2' pitch, and dates from as early as 1620. Only W. L. Sumner explicitly equates this stop with Recorder; another synonym is Block Flute.

SEE ALSO **STOP**

EDWARD L. STAUFF

BLOCKWERK

(Dutch *Blokwerk*) An organ or section of an organ composed of inseparable ranks of pipes. Evidence for large Gothic organs invariably points to a Blockwerk design, where octave and fifth ranks accumulate to reinforce the fundamental, often based upon a double Principal. Although the four-hundred-pipe Blockwerk described by WULFSTAN OF WINCHESTER is probably a hyperbolic account, eleventh-century sources such as THEOPHILUS, the Bern Codex (*Cuprum purissimum*), and the Sélestat manuscript document the presence of several pipes to a note, including octave doublings. Avenary argues that a Hebrew manuscript from the first half of the eleventh century provides the earliest evidence for the use in organ building of mixtures containing fifth ranks. Quoika cites the three inseparable octave ranks of the Freising Cathedral organ as a twefth-century Blockwerk; he also explains the drawing of a positive in Conrad von Scheyern's *Glossarium Salomonis* (traditionally dated 1245) as a six-rank Blockwerk, a highly questionable interpretation.

Michael PRAETORIUS's description of the Halberstadt Blockwerk (1357–61) contrasts the deep rumbling sound of the PRESTANT with the powerful shrillness of the MIXTURE. More information about the fourteenth-century Blockwerk is found in Henri ARNAULT DE ZWOLLE's treatise (ca. 1440), which describes the organ in Notre Dame, Dijon (1350). The Fourniture is specifically mentioned, perhaps because it could be separated from the other ranks. Arnault also provides the dispositions of four Blockwerks, all with increasing numbers of ranks toward the treble. One of these has a compass of F (8 ranks)-e''' (21 ranks) and three types of sound—PRINCIPAL, CYMBAL, and Fourniture—suggesting that it was possible to play them separately by means of a second keyboard or mechanical device. Especially significant is the composition of the three-rank Cymbal, which contains a TIERCE rank, the earliest known reference to this combination.

The threefold chorus division of Principal, Fourniture, and Cymbal described by Arnault de Zwolle was used by Hendrik van den Houwe on his Rückpositiv at St. John's, Malines (1498). It is also documented on instruments in Nürnberg, St. Sebald (H. Traxdorf, 1439–41), Koblenz, St. Florian (1467), Hagenau, St. George (1491), and Louvain, St. Quintinus (1522). By adding new divisions where sounds could be isolated, builders were able to attain diversity without the risk inherent in dividing the windchests of preexisting Blockwerks. VENTIL systems on the new divisions admitted wind into different sections of the chest, making it possible to play the Principals independently of the upper work, and vice versa. But individually separable registers were present on organs by the early fifteenth century. A large positive at the Aragonese royal chapel is reported to have "cinch tirants" in 1420; Arnault describes "quinque registra" (two Principal, two Quints, and an Octave) on the Dijon court chapel organ. When the technology of separable registers was applied to larger organs, spring-chests and slider-chests replaced the old Blockwerks. This occurred very early in Bordeaux, Lombardy, and Tuscany: the organ of San Petronio, Bologna, had nine single-rank stops by 1474–83. The organ built for Utrecht Nicolaikerk (now in Middelburg) represents progressive layers of chest design: both spring-chest and slider-chest divisions were added to the original (1480) Blockwerk F-a'' (8-17 ranks).

KIMBERLY MARSHALL

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BLOWER

A mechanical device to generate the WIND PRESSURE for the organ, supplanting the BELLOWS. From the HYDRAULUS of the ancient Romans through the 1800s the organ bellows was hand- or foot-pumped by human power. By the mid-nineteenth century, bellows were being powered mechanically, by crankshafts attached to water wheels. When pressurized water from municipal water systems became popular, the resulting force water was used to drive pistons to pump the bellows. As the Industrial Revolution continued, steam engines were applied to pumping; even gasoline engines evolved to do the work. The aforementioned approaches relied on bellows fitted with two unidirectional valves: motion of the bellows in one direction filled the bellows with air, while movement in the opposite direction put the air under pressure, exhausting it through the second valve into the reservoir. Human-powered organs could be and were made larger, but this had required increasing the number of pumping stations to accommodate more people. With mechanized pumping, the size of the instrument, in terms of the number of pipes and required wind pressure, could expand to greater limits.

The first modern design innovation and a major break from the use of bellows for organ WINDING came about in England with the invention of the rotary centrifugal air turbine. From the 1860s the turbine moved air for forges, ventilation in ships' holds and large buildings, and eventually for pipe organ wind power, although widespread implementation or acceptance spanned another thirty years. This basic invention utilized the cyclonic action of a rotating set of blades, colloquially called a fan, to spin the air outward within a casing to create the pressure.

Later, these rotary fans were directly connected to an electric motor, removing previous limitations to the volume of pressurized air produced and to the wind pressure itself. This led to very large organs and previously unattainable wind pressures. One consequence was that organ design was radically changed beginning in the early 1900s; pipe scales were increased, PEDAL divisions enlarged, voicing pressures moved upward, and the pressurized air used pneumatically to operate such mechanisms as the SWELL shutters. The world's largest pipe organ, the Atlantic City, New Jersey, Municipal Auditorium Organ, would not have been possible without such power behind it.

However, the unrelenting power of the electric blower risked overwhelming the capacity of the instrument, wearing out movable parts in the winding process. Firms such as LAUKHUFF have devised compensating devices to control the force of the wind pressure. One belated effect of the ORGAN REFORM MOVEMENT has been the somewhat ironic desire for less steady ("breathing") wind, as part of the neobaroque credo. It is impossible to know exactly how Johann Sebastian Bach's standard for steady winding (a documented concern in his examination of organs) would have translated to current technology. In the late twentieth- and early twenty-first centuries, many smaller instruments have returned to human power for winding, while most larger instruments have stayed with electric power. A good number of small and many medium-sized organs offer both options as a compromise.

ALFRED F. SEFL

BODE, HARALD (1909–1987)

German-American builder and inventor. As an experimentalist, a researcher, and a specialist of electronic instrument design, Bode's career spanned over half of the century, passing through three generations of electronic music history, and claiming over thirty patents in the United States, Canada, and Europe.

Born in Hamburg on 19 October 1909, Bode graduated from the university there in 1934, thereafter pursuing graduate studies at the Heinrich Hertz Institute of the Technical University of Berlin. His Warbo Formant Organ (1937) was the first of a series of electronic instruments that would both anticipate the challenges and provide innovative solutions to later electronic instrument design. Using a voice-assignment mechanism that allowed up to four different voices to sound simultaneously, the Warbo Formant Organ foreshadowed similar limited-polyphony common in later electronic synthesizers. His Melodium, built the following year with the assistance of Oskar Vierling, featured improved pitch stability and fewer tuning problems than his first instrument, a pedal for vibrato control, and a tuning-transposition knob. Its outstanding feature, showcased in a performance with the Berlin Philharmonic Orchestra, was a capacity for touch sensitivity and nuance, made possible through a direct keying system linking the varied depression of the felt with corresponding changes in electrical resistance. This afforded the player more subtle and thorough loudness control.

Bode headed several research groups in the field of military electronics at Loewe-Opta in Berlin for six years. By the end of World War II, he had emerged as a champion of the commercial production of the ELECTRONIC ORGAN in Germany. Because the unique construction of the Melodium did not lend itself to mass production, and because of the shortage of material during war, Bode disassembled the Melodium in 1941, using its electronic components to construct the Melochord in 1947. Academic institutions and radio stations took interest in the Melochord, winning him regular airtime on Munich Radio for nearly three years and eventually a commission to build a special Melochord for the Cologne Electronic Music Studio in 1953. These later versions of the Melochord used envelope generators to enhance the consistency of attacks and releases, previously dependent on the inconsistent mechanical efforts of the performer. While the use of electronic envelope generators would later become widespread, the most historically significant characteristics of the Melochord, present from the outset, were its modular design and use of a split keyboard. In addition to making voice-crossing possible between the manuals, the split keyboard involved a "step-by-step" filter that allowed the performer to alter the timbre of one manual by manipulating the other.

Bode began more conventional organ building in 1950 with the Polychord, the first of a series of electronic organs that came to include the Bode organ (1951), the Polychord III (1951), the Cembaphon (1951), the portable Tuttivox electronic organ (1953), and the concert model of the Clavioline (1953). Several more electronic organs were produced after he emigrated to the United States in 1954, becoming chief engineer for the ESTEY Organ Company and researching special sound-producing devices for six years. By the end of that period his research had materialized in the form of a new modular signal processor; his final relocation was to North Tonawanda, New York, where he joined WURLITZER (1960). His later inventions include a new model of the Wurlitzer electric piano, a frequency shifter, a ring modulator, and several sound-processing modules under the name of the R. A. Moog

Co. and, eventually, Bode Sound. He died in New York on 15 January 1987.

Douglas E. Bush

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BOISSEAU

French organ-building family. **Robert Boisseau** (b. Bordeaux, 9 March 1909; d. Poitiers, ca. 28 Feb 1979) started a workshop in Poitiers in 1931, but was interrupted by World War II and Nazi occupation. After the war, he worked for the Roethinger firm in Strasbourg (to the early 1960s); while there he helped rebuild organs at Bordeaux, Ste.-Croix, Bédos de Celles, 1744–46 (1946); Bourges, Cathedral, Merklin-Schütze, 1858 (1952–54); Dijon, St. Bénigne, Riepp, 1740–45 (1953); and Paris, Church of the Madeleine, Cavaillé-Coll, 1869 (1957). Boisseau, who started a second independent workshop in the early 1960s, was later joined by his son Jean-Loup Boisseau (b. Poitiers, 26 July 1940).

At first, Robert Boisseau modeled his work on pre-French Revolution principles, notably those of François Bédos de Celles, such as using hammered pipe metal and his distinctive mixtures. He built new instruments in this style at Limon/Bièvres, Benedictine convent (1959); Paris, St. Nicolas du Chardonnet (1960), Châteauaneuf-sur-Loire (1962), and Levroux. Boisseau later expanded his aesthetic scope to include synthetic approaches, such as the restoration of the organ at Pithiviers, St. Salomon and St. Grègoire, J.-B. Isnard, 1784 (reb. Cavaillé-Coll, 1890; rest. 1960–62, 1965; now electro-pneum.); and by building new instruments at Royan, Notre Dame (1964–80), Monaco, Cathedral (1975; rest. Tamburini, 1988), and Cunault, Notre Dame (1976).

Restoration and/or rebuilding remained a crucial component of Boisseau's work, including organs at Libourne, St. Ferdinand, A. Commaille, around 1890 (1961–62); Autun, St. Lazarus Cathedral, Merklin, 1875 (1962); Beaugency, Notre Dame Abbey (1963); Orléans, St. Paterne, Cavaillé-Coll, 1853 (orig. Paris, St.-Jacques-du-Haut; moved 1856; reconstr. 1965); and Houdan, St. Jacques and St. Christophe, L.-A. Cliquot, 1734 (1969–72). He also held the maintenance contracts for the organs at Paris, Notre Dame (from 1965). The 1733 Thierry gallery organ had been much altered by the work of Cliquot, Aristide Cavaillé-Coll, Charles Mutin, Roethinger (with Boisseau, 1957), J. Hermann (electrification, 1959), and Boisseau again (1960–66). He also rebuilt the 1860 Mutin chancel organ (1968; 2/30, mech./elec).

In 1980, Jean-Loup Boisseau, who had taken on Bertrand Cattiaux (b. Paris, 26 Aug 1955) as partner, moved the firm (now Bosseau and Cattiaux) to Bethines (outside of Poitiers). The Paris, Notre Dame gallery organ was subjected to a major restoration by Boisseau and Cattiaux (1992; 5/110). Its other restorations include St. Denis, Cathedral, Cavaillé-Coll, 1841 (1987); Poitiers, Cathedral, Cliquot, 1791 (1988–94); Cintegabelle, C. Moucherel, 1740, (1989); Sens, St. Étienne Cathedral, Lebé and Mangin, 1722–34 (1990); Toulouse, Notre-Dame-de-la-Daurade, Poirier and Lieberknecht, 1861 (1992); Toulouse, St. Sernin, Cavaillé-Coll, 1888 (1992–96); and Versailles, Château, Cliquot, 1711 (1990s). By 1997, Cattiaux had taken over, employing Jean-Loup's son Jean-Baptiste Boisseau (b. Poitiers, 22 Apr 1965), while Jean-Loup continued as a freelance builder and consultant (Orléans, St. Paterne, rest. 2002).

Richard Kassel

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BOMBARDE

(1) A powerful chorus reed, usually found on the Pedal at 8', 16', or 32' pitch (where it may be called Contra Bombarde), or on the manuals at 16', 8', or rarely 4' pitch. Its resonators are inverted conical metal or inverted pyramidal wood, and may be of harmonic (double) length in the treble. The original Bombarde had a tone midway between that of the Trombone and the

Fagotto, rather softer in tone than the modern stop. It is named after the medieval instrument, a loud treble double-reed still used in some regional folk musics. Wedgwood gives its etymology as deriving from the Latin *bombus*, meaning the buzzing of bees or the coarse blast of a trumpet, and the German *brummen*, meaning to growl or mutter. In the French classical organ, the Bombarde was the chief 16' reed, dating back as far as 1587, but not becoming popular until around 1690.

(2) A manual or reed division based on the Bombarde stop, which grew to include other powerful reeds; this first appeared in the eighteenth century.

(3) On theater organs, a 16' Tuba Mirabilis.

See also **Stop**

EDWARD L. STAUFF

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BONATTI (BONATI)

Italian family of organbuilders. Giuseppe Bonatti (b. 20 March 1668; d. 24 May 1752) completed the Carlo Prati organ in Denno (Prati had died in 1700 while working on that instrument); this suggests that Bonatti may have been a student or an associate of Prati. In November 1701 the renovation of the Eugenio CASPARINI organ in Trento, S. Maria Maggiore, another unfinished Prati project, was transferred to Bonatti; he undoubtedly learned some of Casparini's techniques. Some of Bonatti's instruments are: Civezzano, 1708; Rezzato (Brescia), Santuario di S. Maria in Valverde, 1713; Verona, S. Tommaso Cantuariense, 1716; Cologna Veneta (Verona), Cathedral, 1729; Arco (Trento), Collegiata, 1731; Tione (Trento), 1737, likely in collaboration with Giuseppe's son Angelo Bonatti (b. 30 March 1705; d. 20 Aug 1770); and Bagnolo Mella (Brescia), 1742 (also with Angelo).

As a northern Italian organbuilder at the beginning of the eighteenth century, Giuseppe Bonatti was one of the first to incorporate what he learned from outside builders into traditional Italian methods (including Willem Hermans, a Flemish builder). Among his significant innovations was the separation of the Italian organ into two (or more) divisions, often denoted simply as *organo grande* and *organo piccolo*, the latter not unlike a RÜCKPOSITIV or BRUSTWERK; and the use of slider-chests rather than the spring-chests that remained in common use in, among other areas, Lombardy (through the end of the nineteenth century). Bonatti also expanded the tonal spectrum of his organs with the addition of several stops to the traditional *organo pleno* chorus: Cornetto I (4' + 2-2/3'), Cornetto II (2' + 1-3/5'); Frazolé 2' (a type of Flagioletta), and reed stops (with a preference for short-length resonator reeds). In larger organs the Principal family was also expanded to include a second Principal 8', a Quinte 2-2/3', and a Mixture containing a Tierce (Sesquialtera). Likewise, the Pedal received new independent stops, such as the Trompete 8' in the organ in Verona.

Two organs built by Angelo Bonatti are known: Villafranca (Verona), 1742, and Torri del Benaco (Verona), 1745. Another family member, Girolamo Bonatti, was active in the second half of the eighteenth century, but his relationship to the first two is unclear.

DOUGLAS E. BUSH

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BONAVIA-HUNT, NOEL A(UBREY) (1882–1965)

English organ voicer and scholar. Born in Primrose Hill, Middlesex, on 25 December, 1882, Bonavia-Hunt's early life and education is obscure; he was choirmaster at St. Matthew's, Willesden (1905–12), precentor of All Saints, St. John's Wood (1922–30), and probably vicar at Stagsden, Bedfordshire (1952–55). He then lived in Cranbrook, Kent, presumably until his death.

Bonavia-Hunt spent much of his free time as a freelance voicer and consultant in search of the ideal organ tone (specifically that of the Open Diapason). Opinions on his abilities as a voicer are divided, favoring or questioning his "extreme refinement of tone, and balance throughout the compass." He is known to have voiced a number of instruments in Bedfordshire and other places, notably at St. George's, Kidderminster. In addition, he was consulted about the construction of the Open Diapasons on the Great of the mammoth organ in Liverpool Anglican Cathedral (Henry Willis III, 1912–26) and invited to participate in the voicing of the organ in the Wanamaker department store in Philadelphia.

Regarding Diapason tone, Bonavia-Hunt was an enthusiastic follower of the timbres and principles of the

German organbuilder Edmund SCHULZE, and he spent much time in researching and emulating Schulze's examples. His enthusiasm for his subject is infectious, even when his ideas and opinions are far removed from sound principles. Among his numerous works written on organs, one, *The Organ Reed*, does stand out as remarkable, if only because it is the sole book to date dedicated wholly to that subject.

Bonavia-Hunt only designed one organ: the 1922 instrument by G. H. C. Foskett, originally installed in the Victoria College of Music, London. The organ is now in St. Nicholas of Myra Anglican Church in Worth Matravers, Dorset (rest. Gray and Davison, 1958). It is a tubular-pneumatic instrument blown on 3' (76mm) wind pressure with this specification: Great: Open Diapason 8', Stopped Diapason 8', Principal 4'; Swell (enclosed): Viola da Gamba 8', Flauto Traverso 4'; Choir: Dulciana 8'; Pedal (CC-f 30 notes): Sub Bass 16'; three couplers; balanced swell pedal; tremulant.

DAVID SMIT

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BOND, RICHARD L. (B. 1947)

American organbuilder. Born in Boston on 11 February 1947, Bond began his career as a serviceman in Los Angeles, gaining employment and valuable experience from four local organ-building firms: Steuart GOODWIN (1970–71), Justin Kramer (1970–72), ABBOTT AND SIEKER (1972–73), and Manuel J. ROSALES (1973–76). During this period he built two one-manual organs independently. In 1976 he founded Bond Organ Builders Inc. in Portland, Oregon.

During its first two decades, the firm concentrated on the restoration and rebuilding of organs nearly as much as the building of new instruments (six restorations, nine rebuilds, nineteen new organs) in the northwestern United States. The company developed a particular reputation for innovative reworking of old pipework (tonally and visually) to create new instruments from existing ones.

Bond's exposure to Parisian organs and other European and American models (e.g., the Cavaillé-Coll in Ste. Clotilde, Paris, the Hook and Hastings at Boston, Immaculate Conception, and the Metzler/Wilhelm at St. Thomas Episcopal in Medina, WA) has led to an aesthetic that strives for versatility by combining attributes of Baroque and Romantic organs. This characteristic of his work (French influences, Romantic tonal concepts, and Baroque clarity) is exemplified in his forty-four-rank instrument at St. Stephen's Episcopal in Seattle. Other instruments, all with two manuals and pedal, are: Yakima, Washington, St. Paul's Cathedral (1986); Salem, Oregon, Willamette University (1990); Corvallis, Oregon, First Congregational (1991); Medford, Oregon, St. Mark's Episcopal (1992); Seattle, St. Stephen's Episcopal (1994); Portland, Oregon, Holy Rosary Catholic (1996); and Seattle, St. Andrew's Episcopal (2001).

JARED DONG

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BOODY, JOHN

SEE TAYLOR AND BOODY

BOOT

In the anthropomorphic terminology of organ pipes, the bottom-most section of a REED pipe. The boot rests in a beveled hole in the TOE BOARD and is held in place by the RACKBOARD. When the appropriate pallet is opened, air from the WINDCHEST enters through the toe hole and flows up through the boot until it reaches the the SHALLOT, tongue, and wedge assembly (the reed), attached to a block at the top of the boot. The motion of the reed produces the vibrations that, coupled with the air in the resonator above, results in pitched tones. The equivalent in a FLUE pipe is called a FOOT.

SEE ALSO **STOP**

BORSTWERK

SEE DIVISION

BOSCH BERNATI-VERÍ, JORGE (1737–1800)

Spanish organbuilder. Born in Palma de Mallorca on 8 November 1737, Bosch built chapel organs for two hometown convents, San Jerónimo de Palma (1746) and San Francisco de Palma (1771), and one for Santanyí, Santo Domingo Cathedral (1765). Carlos III summoned Bosch to Madrid, where he completed the Leonardo Fernández Dávila organ for the royal palace at Oriente and was named royal organbuilder. Among his later works are the chancel organ at Seville, Metropolitan Church (destr. late nineteenth century); Madrid, royal chapel, 1778, notable for its treatment of the Positiv as a Swell division and a "Recít Querflöte" constructed of one cylindrical and one rectangular pipe; and Palma de Mallorca, Convento de San Agustin. Bosch Bernati-Verí, probably the best known Spanish organbuilder of the latter half of the eighteenth century, died in Madrid on 2 December 1800; he was succeeded by his brother-in-law Juan Debono. His pupil Gabriel Thomás built organs on Mallorca.

RICHARD KASSEL

BOSSARD

Swiss family of organbuilders who worked in Switzerland, Alsace, and southern Germany; the name is also spelled Bossart and Bosshard. Their activity spanned four generations: Josef Bossard (1665–1748), Viktor Ferdinand Bossard (1699–1772), Karl Joseph Maria Bossard (1736–1795), and Franz Josef Remigius Bossard (1777–1853). Probably an apprentice of Pius Kreusel (1663–1696), a monk from Einsiedeln, Josef Bossard was particularly successful in blending differing national organ styles that produced a unique and unified sound. The earliest and most famous surviving Bossard organ is the imposing instrument (3/30) at St. Urban in Lucerne, built between 1716 and 1721 by Josef and his son Viktor Ferdinand. Italian elements may be seen in the beauty and clarity of the Principals and in the unusual multiplicity of mixture stops (five on the HAUPTWERK alone). A mounted Cornet and inclusion of the Nasard and Tierce stops in the Hauptwerk derive from French influences, while the narrow-scaled stops show South German preferences. The choir organ in Weingarten/Württemberg serves as an example of his work outside Switzerland.

More is known of Viktor Ferdinand's instruments. In 1743 he contracted to rebuild two choir organs (Jodokus Schnyder, 1660; Hans Melcher von Zuben, 1697), followed by the anonymous 1630s organ at the abbey church in Muri (often used in recordings). In 1744 he rebuilt and expanded the organ in the Bern Münster. The choir organ in the Benedictine monastery in Einsiedeln (twenty-five stops) was built in 1754; in 1766 he built the choir organ in the St. Gallen Klosterkirche with its two facing cases (played from one console).

Only one organ survives from the third generation, built by Karl Maria for the Deutschordenskirche in Köniz near Bern; the case still stands, but little of his work remains. Similarly, Franz Joseph Remigius produced several organs, including those in Cham, Buochs, Schwanden, Mitlödi, and the Schlosskirche in Spiez (1831), but only the facades have been preserved in their original form.

Bossard organs generally comprise Hauptwerk, RÜCKPOSITIV, and PEDAL divisions, with mechanical slider-chests and continuous casing. Their instruments closely resemble those common in eighteenth-century southern Germany, but with the inclusion of both French and Italian traits. The Suavial 8' stop appears frequently and is located in the front of the case; like the Italian Voce Umana, it is tuned to provide a Celeste with the Principal 8'. Mutations and reed tongues show French influences. Records show the family built sixty-two new organs, of which forty-one building contracts are preserved in the town archives in Zug, Switzerland.

DOUGLAS E. BUSH

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BOSSI

SEE VEGEZZI-BOSSI

BOTZEN

Danish family of organbuilders. Brothers Johan Petersen Botzen (ca. 1641–1719) and Peter Petersen Botzen (ca. 1661–1711) were the first native organbuilders of importance. Their father, Peter Karstensen Botz (d. 1675), had immigrated into the country, probably from Germany, but the sons were born and bred on Danish soil. The two organbuilders were capable of playing their instruments. Johan Botzen was for a short period organist at St. Canute's in Odense, and Peter Botzen held a similar appointment at Our Lady Church, Copenhagen.

Their chief works were two monumental organs in Copenhagen: Our Lady Church (1690) and Our Saviour's Church (1699). The surviving facade in Our Saviour's, the work of the sculptor Christian Nerger, is full of enigmatic symbols (e.g., two elephants, two clock faces with illustrations of the sun and the moon, and a bust of King Christian V). The explanation is that this is not only a musical instrument, but a symbolic throne conceived as an allegorical representation of the absolute monarch's position of power, between heaven and earth.

One of the most interesting historical organs in Denmark, in Clausholm's castle chapel (ca. 1700), is attributed to the Botzen brothers. It is an instrument of unusually high quality, and both the materials and the workmanship are comparable with the best to be found today. The wooden components are mostly made of oak. The organ has one manual with eight registers and pulldowns.

Ole Olesen

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BOURDON

A narrow-scaled closed 8' flue stop common in French instruments from the Baroque on (*bourdonner*, to buzz), comparable to a Diapason. Grand Bourdons (16' and 32' Mixture stops) are also found. Lower register pipes were wood; upper register were of metal or of the Rohrflöte type. Not found in Pedal ranks until early Romantic American and British instruments, where the scale was widened and the pipes exclusively wood. The earliest reference to bourdons occurs in Albertus Magnus's *De animalibus* (1256–60), where the author specifies that they are the large pipes of musical instruments. Thirteenth-century illuminations of the organ usually depict such long pipes on both portatives and positives, sometimes contained in a separate tower at one side of the case, or as exceptionally long pipes alongside a rank of pipes arranged in a regularly descending contours. It is likely that long pipes seen in late medieval iconography functioned in a similar way to the drones or lowest range of other medieval instruments. This is borne out by references to bourdons in two anonymous thirteenth-century treatises (Anonymous IV and Munich, Staatsbibliothek Cod. lat. Mon. [cim.] 14523), where the term *burdo* suggests a sustained "tenor" (held) voice. The decreasing frequency with which bourdon organ pipes are found in late fourteenth- and fifteenth-century iconography suggests a decline of the use of a drone as expanded keyboard compasses encouraged multipart musical textures.

Henri Arnault de Zwolle (ca. 1440) uses the term *barduni* to designate the lowest completely chromatic octave of notes on a clavichord or organ, with the succeeding octaves respectively called *naturales* and *supernaturales*. This division of pitch into three distinct ranges recalls references to *burdoun*, *meane*, and *treble* in English literature of the fourteenth and fifteenth centuries. The use of *bourdon* to indicate the bass range of a keyboard may be linked to the later application of the term to denote ranks of stopped pipes; when a lower octave was added to a 4' positive, stopped pipes would be required because of space limitations.

References to bourdons appear in French and Dutch organ contracts and payment records from 1383 (Rouen Cathedral) well into the sixteenth century. The expense of these large pipes and the need for special supporting structures to hold them explains this exceptionally full documentation. Other indications for the presence of bourdon pipes are the terms *fistulas tenoris*, *tours*, *trompes*, and *pedales*. A rare iconographical representation of bourdons on Dutch organs is Pieter Saenredam's painting of the Bavokerk organ in Haarlem, Netherlands, with one freestanding tower of five bourdon pipes at the side of the main organ case.
See also **Stop**

Kimberly Marshall

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BOVENWERK

SEE DIVISION

BOX

SEE REGULATOR; WINDCHEST

BOXBEARD

A BEARD attached to the EARS of a FLUE pipe, rather than its cap or LIP.

BOX-BELLOWS

SEE BELLOWS

BOZEMAN, GEORGE, JR. (B. 1936)

American organbuilder. A native of Texas, Bozeman majored in organ performance under Helen Hewitt at North Texas University in Denton. Following college he apprenticed as an organbuilder with Otto Hofmann of Austin, Texas, a pioneer of the tracker revival in the United States. He worked with Joseph E. Blanton in an effort to develop a standard model one-manual organ, receiving a thorough grounding in architectural matters relating to the organ. He was employed by the firm of Sipe-Yarbrough, which later became Robert L. SIPE and Company, Dallas. He was a vice president of the latter firm when he left in 1967 for a Fulbright grant in Austria. In addition to his studies there, he began the study of newer and older organs in thirteen European nations.

Upon returning to the United States, Bozeman was employed by Fritz NOACK in Georgetown, Massachusetts. In 1971 he founded his own firm in Lowell, Massachusetts; it is now located in Deerfield, New Hampshire. Among Bozeman's new organs are: Cortez, Colorado, St. Barnabas Episcopal, 1974, 2/15; Brookline, Massachusetts, St. Paul's Episcopal, 1983, 2/31; New York, Trinity Church, All Saint's Chapel, 1984, 1/13 (in 1912 Hook and Hasting case); Andover, Massachusetts, South Church, 1987, 3/36; and Denton, Texas, First United Methodist, 1998, 3/47. Bozeman has demonstrated his interest in historical instruments through restorations of organs by American builders such as HOOK AND HASTINGS, Ryder, HUTCHINGS, Stevens, Cole and Woodberry, Koehnken and Grimm, PILCHER, JOHNSON, JARDINE, HINNERS, SIMMONS and Willcox, Barckhoff, ODELL, and more recent builders (Otto HOFMANN, Heinrich L. SCHLICKER). In addition to organ building, he has an active career as a church musician and recitalist (North America and Europe). He is a frequent contributor to the *Diapason*, the *American Organist*, and the *Tracker.*

GEORGE BOZEMAN, JR.

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George Bozeman, Jr. and Company Organbuilders. <http://www.bozemanorgan.com/>.

BRABANT

SEE LOW COUNTRIES

BRASS

SEE PIPE METAL

BRAZIL

From 1500 until its independence in 1822, Brazil was under the rule of Portugal. Musical activity during this period took place mostly in the church, in the Portuguese court in Rio de Janeiro (fleeing from Napoleon Bonaparte, João VI took up residence there in 1808), and in the homes of the Portuguese nobility and the rising Brazilian middle class.

Organs to 1800

With the installation of the Portuguese administration in 1549 in Bahia and the building of the city of Salvador, the first organist position was created in 1559 in the Sé (Cathedral) of Bahia. In the seventeenth century there are references to organists and organs in other regions of the country, including Amazonia, Rio de Janeiro, São Paulo, and in the initial areas of colonization, such as Bahia and Pernambuco. In the Amazon region, there are reports that João Xavier Traer, an Austrian Jesuit, built several organs (no longer extant) for the missions in Pará. In the Jesuit areas in Rio da Prata, a seventeenth-century German priest named Antonio Sepp recorded the details of an organ with pedalboard that he had built with the help of Indians from one of the missions.

There are still many questions about the oldest surviving organ, located in the Capela Nossa Senhora do Rosário, in the small town of Embu: a one-manual organ, with five stops based on a Bordão 4'. However, the

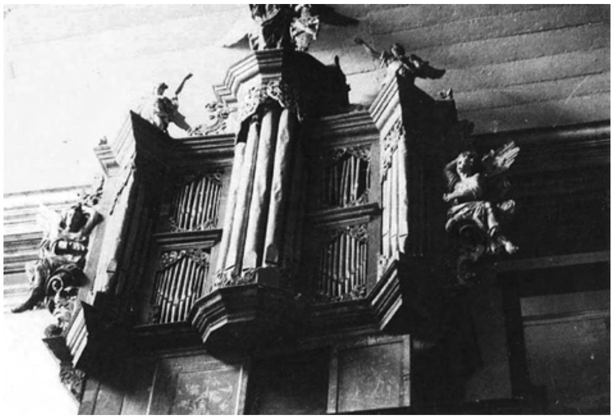

Fig. 18. Schnitger organ (2/18), Mariana Cathedral, Brazil.

instrument does not have the divided keyboard characteristic of Iberian organs through the end of the eighteenth century. The anonymous organ may date from the end of the eighteenth century.

During the colonial period, organs were either brought from Portugal or were built in Brazil. Many of these historical organs have disappeared. The remaining instruments are in poor condition due to atmospheric conditions or refurbishment by unskilled technicians.

Among the oldest organs is the famous Arp SCHNITGER organ, the most important of the colonial period. Built around 1701 for the Igreja Franciscana in Portugal, it was donated by Dom José I to the cathedral of Mariana in 1753. Some scholars maintain that the organ was built by Johann Hinrich Ulenkamp, a Schnitger apprentice who moved from Germany to Portugal. It is likely, however, that it was at least designed by Schnitger in that era's Portuguese style. Its most recent restoration was undertaken by Bernhardt Edskes (2000–2001).

During the eighteenth century there was considerable activity in organ construction by Brazilian builders. The leading builder was Agostinho Rodrigues Leite (1722–1786); his first organ was built for the monastery of São Bento in Olinda, Pernambuco, around 1750. Subsequent organs were built for churches in Recife, Bahia, and Rio de Janeiro (monastery of São Bento). This last instrument, the *Órgão da Coroa* ("Organ of the Crown"), was preserved in its original form until 1925, when a new Klais organ was integrated into the original. In 1956, the original Órgão do Coroa was restored, using eleven pipes from the organ of 1773; it is Leite's sole surviving instrument.

The divided one-manual organ of Tiradentes, Minas Gerais, was built in Portugal and erected in 1788 by Antonio Neto da Costa; this organ, restored in the early 1980s, is known for its vivid facade painted in red, silver, and gold leaf. Other important instruments include an anonymous one-manual, seven-stop Italianate organ, built around 1785 for the Igreja das Chagas do Seráfico Pai São Francisco in São Paulo; the organ in Diamantina, Minas Gerais, built by Manoel de Almeida in 1787; and the organ for the Convento de Nossa Senhora da Lapa in Bahia, built by Antonio Paulo da Silva in 1798.

The Nineteenth Century

Some important instruments from the nineteenth century are found in Salvador, Bahia. The organ of the Igreja Ordem Terceira de São Francisco was built between 1848 and 1872 by Carlos Tappe (Tapper), a German immigrant; the case is richly painted and decorated to match the style of the church's interior, almost entirely gold-leafed. The organ is now in poor condition.

The Igreja Nossa Senhora da Conceição da Praia, one of the largest and historically most important churches in Salvador (Bahia), has an Augustinus Randebrock organ built in 1868, either in Germany or in Brazil. The drawstops are placed to the sides of as well as above the manuals. The organ was restored in 1977–78.

During the latter half of the nineteenth century, Brazil imported a fair amount of its culture directly

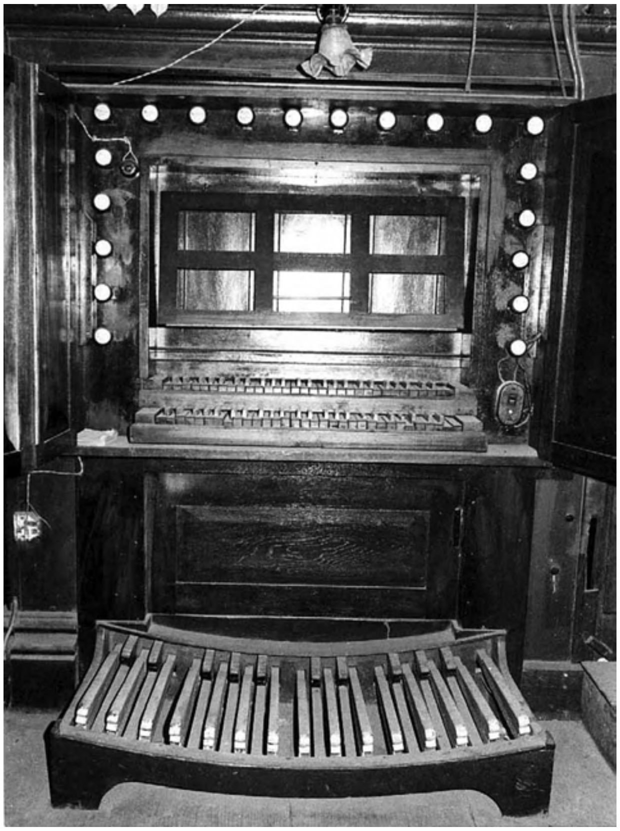

Fig. 19. Randebrock organ, Igreja Nossa Senhora da Conceição Da Praia, Salvador, Brazil.

from Europe. Cultural ties with France were especially strong at this time, and many Brazilians traveled to France for their education. As a result, organs were purchased from the firm of Aristide CAVAILLÉ-COLL for twelve important churches in Brazil between 1852 and 1898. These range from one manual with pull-downs to two manuals and independent Pedal *en tirasse* (with couplers) with up to twenty stops. Unfortunately, most of these organs are in very poor condition today.

Two of the larger Cavaillé-Coll organs were installed in the 1880s. In 1883 an instrument was installed in the cathedral of Campinas, São Paulo. This organ was partially restored in the 1990s; a technician, upon dismantling and opening one of the windchests, discovered several voicing tools. Cavaillé-Coll often included a set of tools when he delivered a new instrument, in order that future technicians would be able to install and maintain the instrument. The largest Cavaillé-Coll organ in Brazil, dating from 1882, is in the Sé of Belém. The organ functioned well until 1948 and was restored in the 1990s.

Other instruments in the Rio de Janeiro area include two MUTIN–Cavaillé-Coll organs (early twentieth century); an 1861 organ by the British builder Wadsworth; and a Wilhelm SAUER organ, now at the School of Music.

1900 to the Present

The progress of the organ movement in Brazil has been hampered by familiar tropical conditions, such as humidity and termites. Economic problems (inflation, high taxes, lack of financial support) have been even greater obstacles; there are also few people adequately trained in the maintenance and preservation of organs. The "home country" of Portugal ceased to exert any noticeable effect on the Brazilian organ movement after the nineteenth century.

However, important gains have been made in organ building and maintenance activities since 1900, thanks mostly to imports and immigrants from Germany and Italy. At present, the largest pipe organs found in South America are Italian imports. One such instrument is the 1956 TAMBURINI at the Igreja Nossa Senhora Auxiliadora in Niteroi, near Rio de Janeiro (7/137, with two consoles); it is in good condition. Two other Tamburini instruments are in São Paulo, including the well-known 1969 Teatro Municipal organ (4/78); another is in Rio de Janeiro. Balbiani and Bossi built instruments for the Cathedral of São Paulo (5/120, now unplayable) and the Colégio Marcelina in Belo Horizonte, Minas Gerais.

German firms were also significant. E. F. WALCKER installed several large cathedral instruments, notably in São Paulo and Rio de Janeiro, in the early twentieth century. RIEGER has a organ at the Igreja São José in Pôrto Alegre, Rio Grande do Sul (1936). There is at least one old tubular-pneumatic STEINMEYER with a Rollschweller in Santa Catarina. German immigrant Guilherme Berner, who apprenticed with Steinmeyer and operated Órgãos Santa Cecília in Rio de Janeiro, was an active renovator. Although he may have done more harm than good at times, he rebuilt historic Brazilian instruments, notably that of the monastery of São Bento in Rio de Janeiro.

J. Edmundo Bohn (1900–1968), who directed the construction of over fifty pipe organs, was probably Brazil's most prolific native builder. Of German descent, Bohn acquired his training by participating in an installation by Rieger. He built his first organ in 1932 in Pareci, Rio Grande do Sul, and later opened a factory in nearby Novo Hamburgo. The Bohn Company was the major producer of organs and harmoniums in Brazil for decades. The earlier Bohn organs were tubular-pneumatic; later they built electro-pneumatic organs. A highly unified two- or three-rank organ that Bohn marketed widely was referred to as the *Orgão Compacto* ("Compact Organ"). He also built several two-manual and pedal harmoniums; one sits in the small concert hall of the Federal University, Pôrto Alegre. The original company has been taken over by an independent firm but continues to service pipe organs, manufacture harmoniums, and represent a digital organ company.

Two instruments in Rio Grande do Sul are unique in that their pipes are made of native bamboo. These electro-pneumatic organs, built by Odilon Jaeger, another Brazilian of German ancestry, are quite successful in spite of their use of unification. The first, from 1952, located at the Colégio Cristo Rei in São Leopoldo, is a three-rank organ with one divided manual; the other, at Colégio Anchieta in Porto Alegre, is a two-manual, three-rank organ from 1966. Other organbuilders and technicians from this century include Manoel Luiz Defaveri, Rio de Janeiro; Warwick Kerr, São Paulo; Salvadore Lanzilotta, São Paulo; Giuseppe Petillo, Rio de Janeiro; Siegfried Schurle, São Bento do Sul; and Federico Wurt, Porto Alegre.

In spite of the strong economic and cultural ties between Brazil and the United States following World War II, U.S. organs were not imported into Brazil until after 1980. These organs were used instruments, donated or sold at very reasonable prices to São Paulo churches. As a result there is a 1911 AUSTIN, now in the Catedral Evangélica (since 1986); a 1930 MOLLER, in the Igreja Presbiteriana Unida (1994); a 1923 Moller, in the Igreja Presbiteriana do Centenário (1996); and a 1934 ESTEY, in the Primeira Igreja Presbiteriana Independente de Osasco (1989). There is also a privately donated 1946 KILGEN in the Primeira Igreja Batista de São Paulo, inaugurated in 1996.

Activity in the Brazilian organ world increased considerably after the founding of the Associação Paulista de Organistas in 1977, the Associação dos Organistas do Rio Grande do Sul in 1979, the Associação Carioca de Organistas in 1983, and the Associação Brasileira de Organistas (ABO) in 1992. These organizations have worked to promote organ seminars and sponsor recital series. Since 1990, the ABO has sponsored separate conventions for organists and organbuilders that have taken place throughout Latin America; the ABO also publishes *Caixa Expressiva*, begun in 1997, with two issues annually, and maintains a website, launched in 2002.

DOROTÉA KERR
JAMES WELCH

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BREBOS

Flemish family of organbuilders, active in Spain. Together with the MOORS and LANGHEDUL families, the Brebos family was very important during the sixteenth and seventeenth centuries. They had a marked influence on the evolution of European organ. The founder of this dynasty, Gommaar Brebos, received his training from Jan Verryt (d. 1548) in Lier. His son, Gilles Brebos (d. 1584) was trained by his father but went to work in Antwerp, where he entered Jan Moors's workshop in 1552. In 1558 Gilles built a little organ in the Cathedral of Our Lady in Antwerp. He rebuilt the Moors organ at Mechelen (1565) and built a new instrument for Antwerp's Notre Dame (1565–67, two manuals, with composer John Bull as adviser). Gilles served as tuner and repairer of these organs. In 1570–71, Gilles Brebos traveled to Italy, joining the exodus of Flemish musicians to that country (albeit belatedly); for him, it seems to have been a study trip only, and he soon returned to Flanders.

No doubt affected by the iconoclast campaign against all "papist" elements, including the use of the organ in worship, Gilles gladly accepted the invitation by Philip II of Spain to construct four organs at the Escorial in 1579; he never returned to the Low Countries. He was assisted in Spain by Gaspar Brebos (d. 1588), Michiel Brebos (d. 1590), and Jan Brebos (d. 1609); usually considered to be Gilles's sons, some believe they may have been his brothers. The largest of the four instruments featured a double-chest Hoofdwerk, a larger-than-usual BRUSTWERK (more like a Positiv division), and an independent Pedal. Stylistically, Brebos brought his Netherlandish manner to the Escorial, but allowed local influences to enter, thereby creating a new synthesis of two previously unconnected national styles. Either way, Gilles died before the job was completed, but his relatives finished the task.

All four organs remain playable; they have been altered over the years, and can now be played together from one keyboard. One of the two large instruments rests in the priory choir (2/35, northern European disposition); of the two smaller organs, a positive (1/8) was restored in 1998. No organs or fragments of Brebos family instruments remain in the LOW COUNTRIES. Hans BREBUS (d. 1603), who may have been related to the family, left the Low Countries to work in Copenhagen. He probably became Protestant and never returned.

FERDINAND J. DE HEN

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BREBUS, HANS (D. 1603)

Danish organbuilder of Flemish birth. Brebus was born in Lier, apparently the son of a organbuilder named Gommaer Willemszoon Brebos, who may have been related to Gilles BREBOS's father, Gommaar Brebos. Hans Brebus settled in Copenhagen not later than 1570, remaining until his death.

In December 1570 he became organbuilder by appointment to Denmark's Frederik II and was thereby responsible for the maintenance and building of new instruments at the royal castles. Among the towns where he built new organs were Elsinore, Næstved, Vordingborg, Stege, and Nyborg; and Helsingborg, Sweden. After the death of Frederik II (1588) he served the new monarch, Christian IV.

Among the instruments built by Brebus are at Helsingor (contract, 1570), Helsingborg (1582), Kronborg (1582), Næstved (St. Peter, 1583–86), Vordingborg (1587), Næstved (St. Martin of Tours, 1587), Stege (ca. 1587), and Nyborg (1588). Brebus also worked in Danish cities now in Sweden: Torrlosa (1580), Malmø (1588), and Marstrand (?1598 or 1603/04; 1/9; rebuilt 1715; restored, 2000; now in Morlanda). He apparently retired to Copenhagen.

The facade at Næstved, St. Peter's (1586) survives. Originally it belonged to a little swallow's-nest organ in the chancel, but today is part of a modern and much bigger instrument on the west gallery. Plans are afoot to make a free reconstruction of the swallow's nest organ in its original position.

Brebus's activities were possibly continued after his death by a son named Henrik, but only for a short period. The organ in Morlanda Church, Sweden, is considered to be a Brebus instrument, but it was delivered in 1604, a year after Brebus's death.

OLE OLESEN

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BREISIGER, PETER (FL. 1516–1542)

German organbuilder. He was probably born in Saffig, near Koblenz. Like Hans SUISSE, Breisiger (also Briesger, Bryssiger) was one of the most important builders of the Middle Rhine region in the early sixteenth century. He is referred to as a *Schöffe* and *Bürger* (lay judge, citizen) of Koblenz. He was active in the upper Rhine: Andernach, Liebfrauenkirche; Koblenz, Liebfrauenkirche, Dominikanerkirche, and St. Florin (1534); Weilburg (ca. 1520); and, his most important organ, Trier, Cathedral (1537–38). His work extended into the LOW COUNTRIES: Maastricht, Dominican Church; Tongeren, Onze Lieve Vrouw; and Munsterbilsen, St. Amor (all 1527–29). In addition to attention to the Principal chorus, he made impressive use of new stops: Quintaden, full-length resonator reeds, Cornet VI or V (Nachthorn VI), and high-pitched Pedal Flutes. For the Trier cathedral organ, Breisiger left an important set of detailed registration instructions that provide insight into the tonal aesthetics of sixteenth-century organ literature.

DOUGLAS E. BUSH

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BRITISH INSTITUTE OF ORGAN STUDIES

The British Institute of Organ Studies (BIOS) is an association made up primarily of scholars, organbuilders and organists, organized during the summer of 1975 and formally inaugurated in 1976. The institute was founded to encourage and assist scholarly research in the history of British organs and organ building as well as the preservation and proper restoration of extant historic British organs. Its membership is primarily British, but includes continental Europeans, North Americans, and Australians.

BIOS publishes a quarterly newsletter, *BIOS Reporter*, containing news, notes of interest, and research queries. The institute's main publication is the annual *Journal of the British Institute of Organ Studies* (Oxford: Positif Press, 1977 to present), containing essays, scholarly articles, and reviews. The institute also maintains a growing collection of primary research documents in its English Organ Archive, housed in the music department of the Central Library of Birmingham. The collection includes materials on such builders as George JARDINE (Jardine and Co., Kirtland and Jardine), William HILL (Hill and Son); HILL, NORMAN AND BEARD, GRAY AND DAVISON, Bevington and Sons, and Robert HOPE-JONES, as well as private notebooks kept by various individuals, photographic plates, and other items.

See also **Organizations**

John K. Ogasapian

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BROKEN OCTAVE

See Keyboard

BROMBAUGH, JOHN (B. 1937)

American organbuilder. A native of Ohio, Brombaugh graduated from the University of Cincinnati and completed graduate work in electrical engineering and acoustics at Cornell University. He worked for one year at the Baldwin Company in Cincinnati, where he received seven patents for his work in electronics. Brombaugh was apprenticed to Fritz Noack (1964–66) and did further study with Charles B. Fisk (1966–67) and Rudolf von Beckerath (1967). He opened his own shop in Middletown, Ohio, in 1968; in 1971 he formed a partnership with Roy Helms, Norman Ryan, Herman Gruenke, George Taylor, and (in 1972) John Boody; the last two later formed Taylor and Boody. Brombaugh moved to his own, larger shop in Eugene, Oregon, in 1977 (now John Brombaugh and Associates).

Brombaugh was among the first United States builders to work from a decidedly historic viewpoint, his work having been strongly influenced by the pre-Schnitger North German and Dutch organs of the seventeenth century and by the music of Johann Sebastian Bach. He remains at the forefront of the Organ Reform Movement in the United States. Brombaugh's organs embrace the best ideals of the post-1960 American organ: mechanical key and stop actions, magnificent ornamented case designs based on north German models, high lead-content flue work hammered to produce a "vocale" musical tone, cone tuning, flexible winding, unequal temperaments, and

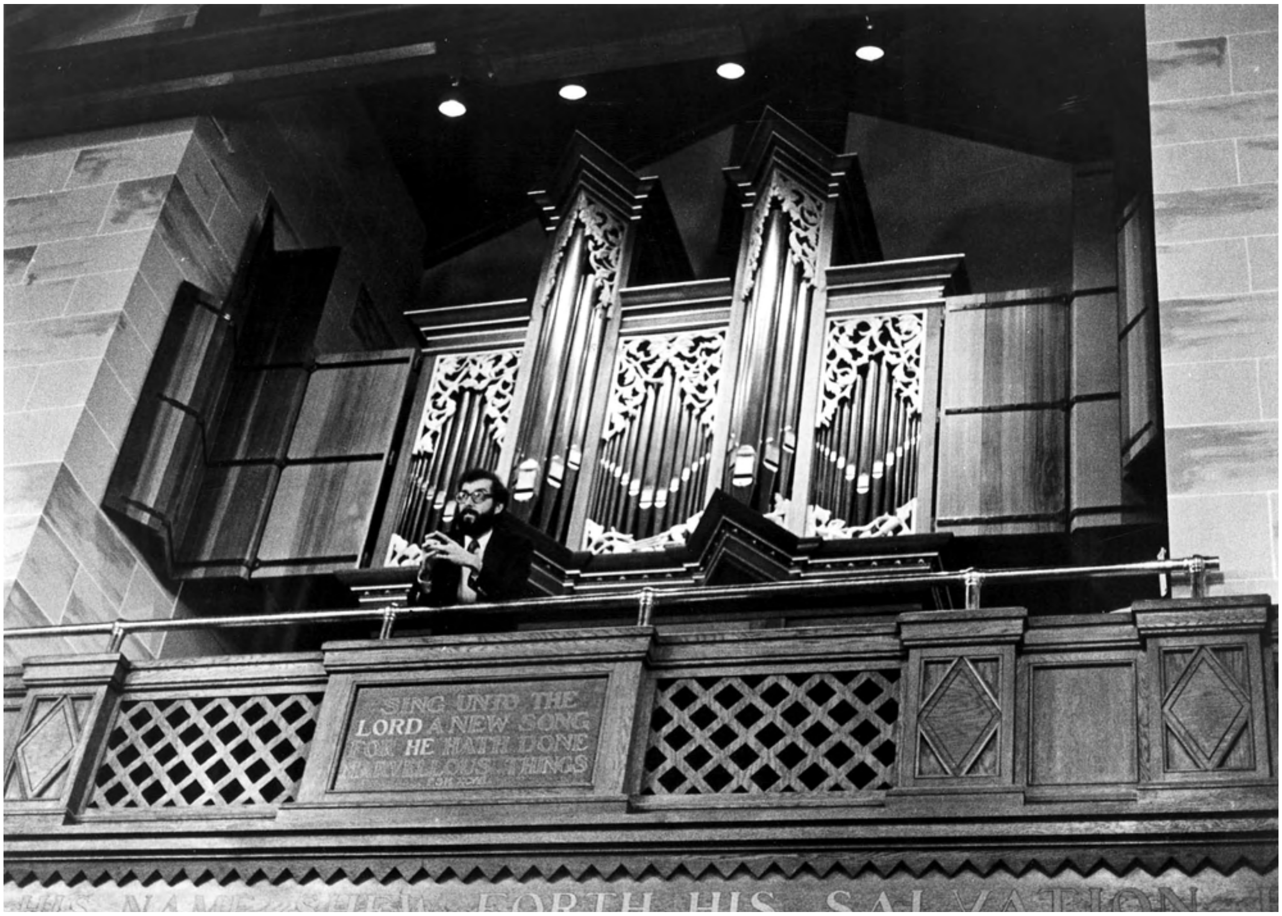

Fig. 20. Organist William Porter stands in front of the Brombaugh organ, 1981 (2/15), Oberlin (Ohio) College, Fairchild Chapel.

suspended key actions. Brombaugh is one of a handful of North American builders who builds all organ components in his shop.

Brombaugh's most important instruments to date include those at First Lutheran, Lorain, Ohio (1970), Ashland Avenue Baptist, Toledo, Ohio (1972), Grace Episcopal, Ellensburg, WA (1974), First United Methodist, Oberlin, Ohio (1974), Central Lutheran, Eugene, Oregon (1976), Christ Church, Tacoma, Washington (1979/1988), Fairchild Chapel, Oberlin College, Oberlin, Ohio (1981; meantone), Southern College, Collegedale, Tennessee (two instruments, 1986; meantone), Iowa State University, Ames, Iowa (1987), Christ Church, Greenville, Delaware (1990), the Hagakyrkan, Göteborg, Sweden (1991; meantone), and Lawrence University, Appleton, Wisconsin (1994).

CRAIG CRAMER

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BRUNZEMA, GERHARD (1927–1992)

German organbuilder, later active in Canada. Born in Emden, Lower Saxony, on 6 July 1927, Brunzema served his apprenticeship with Paul OTT in Göttingen (1948–52) and subsequently studied acoustics at Braunschweig's technical university (1953–54). Brunzema formed a partnership with Jürgen Ahrend in Leer-Loga, East Frisia, in 1953. In 1962 Ahrend and Brunzema were awarded the Lower Saxony State Prize for skilled crafts. Brunzema settled in Canada in 1972, when he assumed the artistic directorship of CASAVANT FRÈRES. In 1979, Brunzema formed his own company in Fergus, Ontario; he died there on 7 April 1992.

Ahrend and Brunzema were among the first twentieth-century builders to work with a primarily historic viewpoint, their work having been strongly influenced by the pre-SCHNITGER North German organs, especially those in Groningen. Brunzema restored many important historic organs in Europe during his partnership with Ahrend, including those in Amsterdam (Waalse Kerk), Hoerstgen, Jennelt, Marienhafe, Rysurn, Uttun, Westerhusen, and the Jörg EBERT organ at Innsbruck, Hofkirche (2/15; rest. 1976). The partnership also produced important new organs in the Netherlands (Aalten, Amsterdam, Groningen, Haarlem, the Hague, Scheveningen, Wassenaar), Germany (Aurich, Bingum, Bremen, Castrop-Rauxel, Emden, Frankfurt-Nordweststadt, Gildehaus, Gütersloh, Hamburg-Altona, Leer, and Uelsen), and the United States (Berkeley, Los Angeles).

During his tenure at Casavant, Brunzema designed significant mechanical action organs for Canada (University of Toronto, 1973; University of Alberta, 1978), the United States (Trinity Lutheran, Moline, IL, 1973; Carthage College, Kenosha, WI, 1976; Trinity Church, Princeton, NJ, 1978; Dordt College, Sioux Center, IA, 1979; First Presbyterian, Boulder, CO, 1979, St. Peter's Cathedral, Scranton, PA, 1979), Australia (Elder Hall, Adelaide, 1979; Victorian Arts Center, Melbourne, 1980), and Japan (Kinjo Gakuin University, Nagoya, 1980; Doshisha Women's College, Kyoto, 1980).

Brunzema's Fergus workshop produced mechanical action organs for Central College, Pella, Iowa (1982), Blessed Sacrament, Kitchener, Ontario (1983), St. Anne's, Glace Bay, Nova Scotia (1986), Holy Family, Toronto (1987), St. John's Episcopal, Charlotte, North Carolina (1988), and Dong Presbyterian, Seoul (1990). In addition, the firm sold a large number of "Kistens" (chest organs)—compact, cleverly engineered continuo instruments of three or four stops.

CRAIG CRAMER

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BRUSTWERK

The term *Brustwerk* is German ("breast division" or "chest division"; Dutch, *Borstwerk*), meaning a small DIVISION located just above the CONSOLE, under the HAUPTWERK (or its equivalent). The word *Brust* appears in the writings of Arnolt SCHLICK and Michael PRAETORIUS (*Brustpositiff* in the latter), but the present term was standardized in the eighteenth century.

As Praetorius suggests, the Brustwerk could be seen as a POSITIVE built into the main chest (i.e, Hauptwerk). However, the Brustwerk was generally characterized by reed stops; Regals were almost always included (on some organs, this was a full division, or *Schnarrwerk*). Placing these pipes just in front of the player made it easier to tune them. A *Brustpedal* had the pedalboard connected to it (Antwerp Cathedral, van der Distelen, 1505). Modern German organs often have Brustwerks enclosed within a SWELL box, representative of neither the original Brustwerk nor the nineteenth-century *Schwellwerk*.

FERDINAND J. DE HEN

BRYCESON

English organ-building firm, known variously as Bryceson Brothers, Bryceson and Bryceson, or Bryceson and Son. Founded in London by Henry Bryceson (ca. 1796), Bryceson remained a small but active firm throughout its history; an early instrument survives at York, Castle Museum (1816). The firm was dedicated to making barrel organs as well as pipe organs (Bracknell, Holy Trinity, ca. 1850; Huntingdon, All Saints, 1864; Penzance, St. John's Hall, 1867). In the 1860s, the firm experimented with hydraulic control of the Swell mechanism. But its historical significance truly begins in 1868, when Henry Bryceson Jr. acquired sole rights to use Charles S. BARKER's "practical electric organ mechanisms" in England. In that year, the firm built and installed electric key-action instruments at London, Drury Lane Theater; Camberwell, Christ Church (first used at the Three Choirs Festival, Gloucester); Cornhill, St. Michael's; and Tufnell Park, St. George's. Bryceson published an article on the "Electric Organ" in the *Musical Standard* (28 Mar 1868). The firm also supplied the organ for the Three Choirs Festival in Worcester (1869).

The firm's later instruments include Cookham Dean, St. John the Baptist (ca. 1870); London, St. Botolph, Aldersgate (reb. 1778 Green, 1872); Norwich, Cathedral of the Holy and Undivided Trinity (reb. 1760 J. Byfield II, 1878); and Norwich, St. Andrew's Hall (collab. Alexander J. Ellis, 1880; rest. Hill, Norman and Beard, 1983). Bryceson organs also found their way to New Zealand (Silverstream, St. Margaret, ca. 1865) and Australia (Menangle, NSW, St. James, 1878). The firm was purchased by Alfred Kirkland (1857–1927) in 1893 and absorbed by HILL, NORMAN AND BEARD in 1923.

RICHARD KASSEL

BUNGBOARD

The wooden horizontal back piece of the pallet box which, when removed, allows examination and maintenance of the pallet mechanism; sometimes spelled bung board. This term may apply to instruments using older as well as universal windchests. There is no equivalent to this bit of English vernacular in other languages.

BURNETT, RICHARD (LESLIE) (B. 1932)

English collector and fortepianist. Born in Godstone, Surrey on 23 June 1932, Burnett was a piano student of Peter Katin. His interest in older instruments led to his 1975 fortepiano recording of Schubert's Schöne Müllerin with early music specialist Nigel Rogers. From the late 1960s, Burnett has built up a collection of chamber organs (notably a 1766 Byfield II) and other keyboard instruments; these have resided at Finchcocks, Goudhurst (Kent) as part of a museum and music center since 1971. Most instruments are in playable condition, and several recordings have been made there.
See also **Instruments, collections**

RICHARD KASSEL

BYFIELD

English organ-building family. The string of builders with the same name has caused confusion in determining responsibility for the building of particular instruments. John Byfield I (1694–1751) was the brother-in-law and partner of John Harris (d. 1743, son of Renatus HARRIS); he also collaborated with Richard Bridge and Abraham Jordan. Renowned for his excellent reed stops, he built many high-quality organs in London (among them St. Helen, Bishopsgate, 1744). He was succeeded by his son, John Byfield II (d. 1774); surviving examples of the latter's work include Dublin, Christ Church Cathedral (1752), London, St. Mary's, Rotherhithe (1764–65), and Goudhurst (Kent), Finchcocks (chamber organ, 1766). He worked with Samuel GREEN until his death. His son, John Byfield III (d. ca. 1799), worked for Green as a tuner and repairer. The last family member involved in the trade, John Byfield IV (1766–1806), was also involved in tuning and maintenance; he became organbuilder in ordinary to the king in 1794.

JOHN POWER

C

CABINET ORGAN

See Chamber Organ

CADIRETA

See Rückpositiv

CAHMAN

North German/Swedish organbuilders. Hans Henrich Cahman (b. probably Schleswig, ca. 1640; d. Stockholm, 5 Sept 1699?). He worked in Hamburg with his father-in-law, Hans Christoph Fritzsche (son of Gottfried Fritzsche), until Fritzsche's death in January 1674; Cahman completed Hans Christoph's last instrument in Neuenfeld. In 1676, Cahman obtained a royal privilege in Copenhagen, although he lived in Flensburg until around 1680. In 1684 he repaired the organ in Landskrona, Sweden; he then moved to Sweden, where he introduced the North German tradition of Fritzsche. His work laid the foundation for Swedish developments of the late Baroque organ, and today he is regarded as the father of Swedish organ building. The organ he built for Uppsala Cathedral (1692–98) was the largest organ in Sweden at the time (3/51, 32′ case; destr. 1702). A well-preserved organ built for Virestad (now in the Smålands Museum, Växjö) attests to the craftsmanship and tonal quality of his work.

Johan Niclas Cahman (b. Flensburg, 1679 or 1680; d. Stockholm, 18 June 1737) was the son of Hans Henrich. Having apprenticed with his father, he took over the workshop in 1699. Between the years 1700 and 1711 he lived in Västerås, returning to Stockholm to work as a city tax official between 1711 and 1721; during this period his organ-building activities subsided considerably. From his retirement in 1721 from civic office until his death, he had his most productive period as the leading organbuilder in Sweden. During this time he built thirty organs, including the cathedral organs in Västerås, Härnösand (1731), Uppsala (1731), and Linköping (1733).

Johan Niclas departed from his father's North German Baroque style, cultivating an organ with narrow-scaled Principals, mixtures with Thirds, a limited number of mutation stops, and fewer reeds (Trompete, Posaune, Vox humana). His early instruments often included a Rückpositiv and pedal towers; after the 1720s the Rückpositiv was abandoned in favor of an Oberwerk, creating the late Baroque Swedish facade that remained in favor into the 1760s. Johan Niclas's instruments are particularly noted for their woodwork, metal pipework, and technical design. The Cahman workshop was later taken over by a colleague, Olof Hedlund (d. Stockholm, 20 Feb 1749).

Douglas E. Bush

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CALCANT

From the Latin *calcare*, "to tread," this term means (1) the person or persons occupied with raising the bellows of the organ and thus supplying the instrument with wind; and (2) a drawstop found in old organs used to gain the organ blower or calcant's attention. The drawstop usually activated a bell or other apparatus that signaled that the calcant should begin treading, pumping, or raising the bellows. This archaic term has all but disappeared since the advent of electric blowers.

David Smit

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CALLIDO

Italian organ-building family. It is not known with whom Gaetano Callido (b. Este, Padua, 14 Jan 1727; d. Venice, 8 or 12 Dec 1813) first studied organ building, but his first instrument was installed in Padua, Casale de Scodosia (1748). He then entered into an apprenticeship with the famed organbuilder Pietro Nacchini; in 1763 he commenced working independently. With the enthusiastic recommendation of Nacchini, Callido received the contract for an organ at Treviso, Collegiata of Asolo. Within a short period he received a number of contracts outside the Venetian area, extending as far as Constantinople. In 1766 he was contracted to rebuild the three organs of St. Mark's in Venice; in 1770 he was named conservator of the those organs, with a yearly stipend of 45 ducats. In 1786 his annual stipend was increased 8 ducats, with the understanding that he would build a portative for the *cappella* without charge.

Gaetano Callido was among the most important figures in the eighteenth-century Venetian organ-building school; founded by Nacchini and extending over the Alps through his pupil Franz X. Chrismann, this school was crucial in the development of the classical Italian organ. Callido's workshop averaged about ten instruments per year; he built some four hundred organs, primarily in and around Venice. His organs include the standard ripieno, with divided stops (*bassi* and *soprani*). The one addition to these labial stops was the Violetta 4'. Another innovation was a short-resonator regal stop in the facade. The ranks of the ripieno were based on the wide scale of the Principals; the Italian open flute does not appear in Callido, who preferred either a conical or a chimney flute, and occasionally even used a stopped (Gedeckt) flute. Most of Callido's facades typically use one flat, or field, of pipes. Other elements are typical of Venetian organ building in general: while elsewhere in Italy the Voce Umana pipes were tuned sharp, in Venice they were tuned lower. Venetian builders came to use the slider-chest exclusively, while the Lombard builders continued to use the spring-chest.

Gaetano's sons Agostino Callido (d. Venice, 29 June 1826) and Antonio Callido (b. Venice, 11 April 1762; d. there, 18 Nov 1841) began early on to work with their father (Agostino by no later than 1779). The sons' involvement gradually increased, especially in projects further from home; in 1806 they took over operation of the business. They inherited the family workshop and worked together until Agostino's death; Antonio continued the firm until it was taken over by Pietro Bazzani in 1821.

The second Callido generation introduced new stops to the ripieno: Flutta soprani or Flauto reale (an open cylindrical 8' Flute), Viola bassi 4', Ottavino 2' (a Flute stop), and long-resonator reeds such as the Fagotto bassi 8', Clarinetto soprani 8', and Corno Inglese soprani 16' (also called Corni da Caccia). This more eclectic style exerted a strong influence on the work of Sebastiano Vici, the Martinelli brothers, and the Morettini family; it spread along the Italian-Dalmatian Adriatic coast and remained intact until the mid-nineteenth century.

Douglas E. Bush

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CALLINET

See Daublaine-Callinet

CALLIOPE

See Mechanical Organ

CAMPANA

A Flute stop of 1/2', 1', or 2' pitch, which breaks back every octave like a mixture rank. Most of the known examples, however, are mixture stops. As suggested by its name, the tone of this stop is intended to be suggestive of bells.
See also **Stop**

Edward L. Stauff

CANADA

The history of organ building in the country of the "true north" resembles that of the United States, only a century later. However, three major historical differences have influenced Canadian organ building. First, Canada's independence was achieved through a British government–sanctioned transition. Second, unlike its southern neighbor, Canada's two largest ethnic groups, the English and the French-Canadian, have lived together in an at times uneasy peace; the province of Quebec remains the base for French-speaking Canadians, with its own nationalist leanings. Finally, although Canada's land area (3.8 million square miles) is slightly larger than that of the United States (3.6 million), its population (in 2001, 31 million) is a fraction of that of the United States (281 million). Two cities—cosmopolitan French Montreal and more conservative English Toronto—have remained the primary urban centers for its people, culture, and economic wealth; the St. Lawrence River is by far Canada's most significant waterway. Smaller cities such as Calgary, Edmonton, Ottawa, Quebec City, Vancouver, and Winnipeg have become magnets in their own right relatively recently.

In the Canadian organ-building trade, these factors have led to effects that a larger, less-centralized country such as the Unites States has not experienced. There were and remain a limited number of active organbuilders in Canada. The market is small enough to have dominated by a single builder, Casavant Frères, for several decades. That builder was slow in responding to the winds of post–World War II change (the neobaroque and neoclassical organ movements); instead, smaller builders, both local and immigrant, produced the organs now demanded by church organists and academic institutions. Under pressure to meet the new requirements, Casavant gradually acceded to them. Like the United States, postwar Canada continues to learn from European experience, but has generated nuances on its own and begun to returned the favor of influence to the Old World.

Quebec

The earliest known Canadian organbuilder was associated with the Jesuits who arrived in the seventeenth century. An anonymous instrument in the Jesuit chapel in Quebec City (ca. 1664) was restored by Paul Jourdain dit Labrosse (ca. 1697–1769) in 1721–23. He built a few other instruments before becoming a full-time cabinetmaker. Jean-Baptiste Jacotel I (d. 1832) came to Montreal (ca. 1820) and opened a workshop to build organs and automatons. At his death, his son Jean-Baptiste Jacotel II and Auguste Fay continued the firm as partners before separating into individual businesses. Fay built instruments along the St. Lawrence, between Quebec City and Trois-Rivières. All of the Labrosse, Jacotel, and Fay organs have disappeared.

Joseph Casavant (1807–1874), a blacksmith, used the treatise of François Bédos de Celles to finish a Jacotel organ at Montreal, Ste.-Therese-de-Blainville (ca. 1834). This led to his first commission, for Montreal, St. Martin de Laval (1840). He established a workshop in the Montreal suburb of St. Hyacinthe (later site of the Casavant Frères, Orgues Létourneau, Guilbault-Thérien, and, initially, Karl Wilhelm firms) and built a total of seventeen instruments before his retirement in 1866, including Roman Catholic cathedrals in Ottawa (1850; 3/18), Kingston (1854), and St. Hyacinthe (ca. 1859, reb. anon. 1828 organ). Except for pipes in an organ his sons later rebuilt (Montreal, Mont-St.-Hilaire), Joseph Casavant's work has disappeared. His successor, Eusèbe Brodeur, built tracker organs in Quebec: Cacouna, St. George, 1888 (rest. Létourneau, 1991), Sainte-Monique de Nicolet,

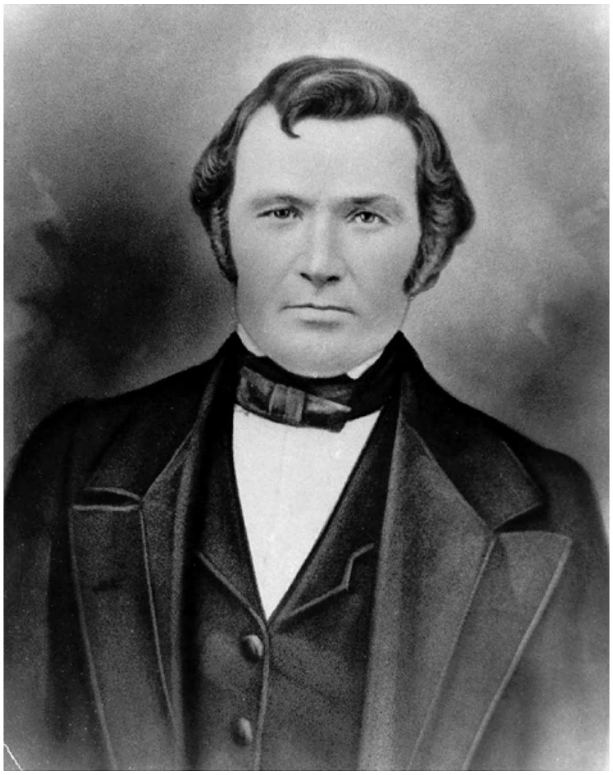

Fig. 21. Joseph Casavant.

St. Monique, 1893 (rest. Létourneau, 2002), Les Cèdres, St.-Joseph-de-Soulanges, 1898 (rest. Orgues Providence, 1975), and Ste.-Anne-de-Sorel, 1905 (his last). His place in Canadian organ-building history was assured with his teaching of the Casavant brothers, for whom he later worked (from 1890).

Napoléon Déry (1843–1908) worked in Quebec City and built tracker organs for nearby churches, including St. Roch des Aulnaies, 1874 (rest. Guilbault-Thérien, 1978), St. Isidore de Dorchester, 1889 (rest. Guilbault-Thérien, 1979), and St.-Michel-de-Bellechasse, 1897 (rest. 1975). These organs, in excellent shape even before restoration, played a significant role in convincing 1950s Quebec organists to revive mechanical tracker action. Déry organs at Neuville, Saint-François-de-Sales, 1885 (reb. 1953, now electro-pneum.) and Quebec City, St. John the Baptist, 1886 (reb. Casavant, 1921, now electro-pneum.; rest. Cavalier, 1976) were altered in later years. The characteristic Déry disposition—mixtures without Tierces, soft Principals, limited Pedal stops—suggests a Romantic, nonsymphonic hybrid of English and French characteristics. This became the philosophy for most Canadian builders: a healthy lack of chauvinism—notwithstanding internal ethnic tensions, U.S. competition, or the postwar influx of German and Dutch builders—and a willingness to blend characteristics of national organ-building schools.

The first widely recognized Montreal builder was neither from Quebec nor Canadian. Samuel Russell WARREN, born in Rhode Island, apprenticed under Thomas APPLETON in Boston before coming to Montreal in 1837. Warren developed a business that, by the 1860s, had made him Quebec's most important builder; several important churches in Montreal had mechanical organs built by Warren or a successor firm. Perhaps his most impressive and controversial instrument was intended for Notre-Dame Basilica, 1857–61 (orig. plan: 4/89). Vehement disputation between Warren and his critics was mostly motivated by his nationality. The poorly funded organ never had more than twenty working stops, and was left unfinished until Casavant superseded it in 1885–91. More successful (and surviving) Warren instruments in Montreal are in St. Patrick's Basilica, 1852 (rest. Orgues Providence, 1972) and St. George's, 1870 (reb. Guilbault-Thérien, 1984, now mech./electro-pneum.). He also built organs for smaller towns in Quebec (few survive). In 1878, Warren relocated to Toronto, the year he built an instrument for Winnipeg, Holy Trinity (dismantled). A year later, his son Charles S. Warren became a partner; the firm reasserted itself with the three-manual organ at Toronto, St. Michael's Cathedral (1880). The following years saw the firm's decline amid increasing competition. The firm was bought out in 1896 by an Ontario reed organbuilder, Dennis W. Karn (1843–1916), who built pipe organs with C. S. Warren as Karn and Warren (Toronto) before turning full-time to player pianos.

Samuel Warren's most significant apprentice, Montreal-born Louis Mitchell (ca. 1823–1902) first opened a workshop with another former Warren apprentice, Charles Forté, then went out on his own. A few of his instruments survive: Vaudreuil, St.-Michel, 1871 (rest. Létourneau, 1987) and St.-Fabien de Panet, 1872 (rest. Juget, 1996–97); but his most important instruments are gone: Quebec City, Cathedral, (1864; reb. 1804 Elliot organ), Montreal, St.-Jacques (1867); Chicago, Holy Family, 1870; and St. Boniface (Manitoba) Cathedral, 1874. Mitchell's pipework was particularly prized; he began making his own in 1874, using the traditional tin-lead alloy (even pure tin) rather than switching to zinc, as Warren and others had done. His last important organ stands in Tignish (PEI), St. Simon and St. Jude, 1882 (rest.). The firm closed in 1893.

Ontario

The first Canadian organ-building family of note was led by John Morgan Thomas (ca. 1805–1875), who began a workshop in 1832 in Montreal; he built new headquarters for the THOMAS ORGAN COMPANY in Toronto in 1844. Little is known about his work; after his death his son Edward G. Thomas (d. 1891) took over. The firm's manager, James Dunlop, became sole owner by 1895. By this time, the business had shifted to manufacturing reed organs, exporting them to Europe and Australia/New Zealand. Yorkshire-born Richard Coates (1778–1868) came to Quebec City in 1817, then moved to York (renamed Toronto in 1834). He built barrel and keyboard organs for the Children of Peace, a dissenting Quaker sect located in Sharon, Ontario; one barrel organ (ca. 1820; rest. Payzant and Duncan, 1979) is housed in a museum there.

Another Englishman, Somerset native Edward Roome Lye (ca 1828–1919), emigrated to Toronto in 1856, working in cabinetry until 1868; however, he was engaged in organ building by 1862, and founded Lye Organ Co. in 1864. In 1875 he moved to larger premises in Toronto; his four sons gradually joined the firm, renamed Edward Lye and Sons. During the founder's directorship, the firm built over three hundred instruments, specializing in two-manual tracker organs, foundation-based with well-blending upper work. Reasonable pricing and good craftsmanship secured their success. Lye instruments found their ways into numerous Toronto churches and secular locations as well as elsewhere in Ontario. It was probably the first firm to place organs throughout Canada, from the Maritime Provinces to British Columbia (and possibly the Yukon Territory). Although the firm continued after Edward's death, the Great Depression forced a restructuring; the firm attempted to combine traditional with newer technology; the last new Lye organ was built in 1954.

Casavant Frères and Legge

During the nineteenth century, English as well as American instruments were imported in sizable numbers. It was not until Casavant Frères began that an autonomous Canadian organ–building profession could be said to be firmly established. The sons of Joseph Casavant, Claver Casavant and Samuel Casavant, did not succeed him immediately when he retired (1866). Claver apprenticed with John ABBEY in Versailles in 1878; the brothers then toured western Europe, viewing organs and workshops. They formed Casavant Frères in St. Hyacinthe, near Montreal, in 1879. The typical Casavant organ's specifications followed the French Romantic principles of Aristide CAVAILLÉ-COLL while avoiding the more symphonic elements of the nineteenth-century organ. The firm was credited with several important mechanical developments, including an early adjustable combination action (1885) and a system of key contact and tracker touch mechanism on electric actions that is still in use. Like most other North American builders, Casavant Frères gradually moved from building mechanical action instruments to building exclusively electro-pneumatic organs by the 1940s.

Another Canadian builder active during the first half of the twentieth century was Charles Franklin Legge (1891–1948), who founded a firm in 1915; his son, William F. Legge, joined in 1919. The most famous Legge organ was installed at Casa Loma, a medieval-style castle built for a wealthy railroad man (1914; 3/100). The organ was sold at auction in 1923 to the future Canadian Broadcasting Corporation (CBC), which used the Legge in radio programs until 1966. Legge built over 250 instruments, most with all-electric action, enclosed divisions, and typically English Diapasons and reeds, as well as player organs. He sold the firm a year before his death; William Legge and another son, C. F. David Legge, continued building organs into the 1970s.

Return to the Past

The founding of the Canadian Guild of Organists (CGO) in Toronto (1909), later the Canadian College of Organists (1920), then the Royal Canadian College of Organists (1959), was more than the creation of yet another professional guild. While the original CGO was Anglo-Canadian in orientation, the French-Canadian element began to assert itself to the extent that, by the postwar era, the latter group dominated its policies. This change corresponded to the increasing interest among Montreal organists in instruments more appropriate for the music of French composers before 1800. Canadians, hearing recordings of neoclassical European organs, found their own instruments wanting. When Casavant and larger American firms proved unable or unwilling to meet the needs of Canadian organists and academics, they turned to European builders, including the eclectic Rudolf von BECKERATH, who built three instruments for Montreal: St. Andrew's, 1959 (orig. Queen Mary Road United, moved 1962; rest. Wolff, 1994); St. Joseph's Oratory, 1960 (Italianate); and Immaculée Conception, 1961. These three instruments were the focal points of the important Ars Organi concert series (1960–73), in which performances by native and foreign players, commissioning of new works, and CBC broadcasts of these and other concerts created a interest in the "new orthodoxy." A by-product was a substantial increase in performances of preclassical music, especially the German school culminating in Johann Sebastian Bach.

Other central European builders decided to meet the Canadian neobaroque movement head-on by emigrating to Canada. The first to arrive, Gabriel Kney, came to London, Ontario, in 1951; in 1955, he formed a partnership with John Bright; a year later, they built the first new tracker organ in postwar Canada. The firm focused for a time on electro-pneumatic instruments such as Brantford, Ontario, Harmony United, 1950s (reb. Blair Batty, 1998). In 1967, Kney started his own firm in London; using neobaroque specifications, he shifted to combined mechanical/electric actions at London, Aeolian Hall, 1971 (to Waterloo, First United, 2003); Calgary, Christ Church, Elbow Park, 1978; and Toronto, Roy Thompson Hall, 1982. Kney later focused on tracker organs; by 1990 he had built over one hundred organs, with his clientele mostly in the Great Lakes region.

Casavant Frères brought in three other builders to help bring that firm into the neoclassical age: Karl Wilhelm, who arrived in 1960; Hellmuth WOLFF, in 1963; and Gerhard BRUNZEMA, in 1972. Each in turn left Casavant to start their own firm: Wilhelm in 1966, Wolff in 1968, and Brunzema in 1979. Working in Mont-St.-Hilaire, Wilhelm built WERKPRINZIP-based, suspended tracker action instruments with flexible wind and German stoplists for churches in Quebec, Ontario, and over half of the United States. Wolff, working in Laval, Quebec, built in a French classical style, but demonstrated an eclectic approach to style. Mechanical organs include Montreal, McGill University, Redpath Hall, 1981 (modeled on Bédos de Celles); Montreal, St. John's, 1983 (German stoplist); Montreal, St. John the Evangelist, 1984 (English stoplist); and University of Toronto, Knox Chapel, 1994 (Dutch stoplist). Like Kney, Wolff's market included the Great Lakes, in addition to instruments in Montreal and New York.

Brunzema's partnership with Jürgen AHREND in East Germany had established his reputation in the new orthodoxy long before coming to Casavant. Many of his Casavant designs produced organs that continue to garner great praise. Setting up his own firm in Fergus, Ontario, Brunzema developed a transportable four-stop continuo organ (the "Kisten") for general consumption. He built an organ at Kitchener, Ontario, Blessed Sacrament, 1983 (added BRUSTWERK, 1991), used in several recordings. Brunzema's limited output was mostly small tracker organs for home use; his instruments reached the United States, Australia, and Japan.

Casavant continued to build its large electro-pneumatic instruments (Quebec, Saints-Martyrs-Canadiens, 1959), but began a spirited response to the authenticity movement under the direction of its president, Charles Perrault, and tonal advisor (later director) Lawrence I. PHELPS. The firm built its first two-manual tracker revival organ in 1961; however, Casavant's status as a serious proponent of change emerged with the Phelps/Wolff instrument at St.-Pascal de Kamouraska, Quebec, 1964. Under the directorship of Jean-Louis Coignet since 1981, Casavant continues to build tracker organs, but relies on electro-pneumatic action for its larger neoclassical instruments. The recent neoromantic revival has benefited Casavant (as well as its competitors). It is very active in restoring its own instruments, including Montreal, Notre-Dame Basilica, 1885–91 (rest. 1991); Montreal, Très-Saint-Nom-de-Jésus, 1915 (gallery and chancel organs; rest. 1986–99); and Toronto, Metropolitan United, 1930 (largest organ in Canada; rest. 1998). Casavant remains one of North America's largest organ-building firms; 80 percent of its organs go to U.S. locations.

Canadian-born builders began to take their place in the burgeoning neobaroque scene. Some continued to go through the Casavant career path. Fernand LÉTOURNEAU worked with Casavant (1965–78), then set up Orgues Létourneau Ltée. in Ste.-Rosalie (1979; moved to St. Hyacinthe, 1984); he is equally involved in building new organs and reconstruction and restoration work. The complicated history of GUILBAULT-THÉRIEN began with Providence Organ Co. (St. Hyacinthe), founded by Maurice Guilbault (1903–69), a former Casavant worker. Shortly before his death, Maurice ceded control of the firm to his son André, who had joined in 1955. In 1968, André brought in another former Casavant employee, Guy Thérien, to form what became Guilbault-Thérien in 1978. It built a series of large tracker and small chapel organs for Canadian and U.S. destinations. Their dispositions were classical French, with a Swell division on occasion. In 1981, the firm moved in 1985 to St.-Thomas-d'Aquin (QC). When André Guilbault retired in 1992, Alain Guilbault (no relation) became Thérien's partner. After Thérien's death in 2001, Alain Guilbault reconstituted the firm with new partners, renaming it Guilbault Bellavance Carignan. In 2003, the firm restored a 1952 electro-pneumatic Casavant at Laval, St. Christophe.

Notable among the other firms contributing to recent Canadian organ history was the Keates Organ Company, founded in 1945 to build pipe organs. In 1951, Keates acquired Woodstock Pipe Organ Co. (a descendant of Karn-Warren); in 1971, it became Keates-Geissler Pipe Organs Ltd.; now in Guelph, Ontario, Keates makes electro-pneumatic organs controlled by solid-state components, with "tracker touch" on the manuals. Other firms have included Santoire (Quebec), founded in 1975 by a grandson of a Casavant worker, specializing in Casavant restorations; Dodington and Dodington (Alymer, Ontario, 1976), representing Casavant in its region, rebuilding organs, and performing solid-state conversions; KJR and Associates, Inc. (Ponte Claire, Quebec, 1978), founded by Karl J. Raudsepp, a leading Canadian organ historian and consultant, working on restorations exclusively; Grant Smalley (Victoria, British Columbia, 1990), a former Kney employee, builds and restores tracker organs; Laliberté-Payment (Repentigny, Quebec, 1984), restoring instruments and holding numerous maintenance contracts; and James Louder (Montreal, 2000), a longtime Wolff employee. JUGET-SINCLAIR began as a workshop led by a French émigré, Denis Juget, who came to Quebec in 1984 and worked for Wolff and Wilhelm. In 1994, he established a workshop in St.-Basile-le-Grand, near Montreal; in 1998 his employee Stephen Sinclair became a partner, and the firm moved to Montreal itself. Juget-Sinclair concentrates on house organs and other smaller instruments, having built an "orgue portative" (organetto) for the early music group Ensemble Anonymus in Quebec City (2001).

The National Library of Canada (Ottawa) sponsored an exhibition, "Pipes and Pedals: Chronicles of Canadian Organs and Organists" in 1983, symbolizing the success of the organ revival there. In the 1990s, economic constraints and church disaffection (a result of post–Vatican II liturgical reforms) were offset by restoration of late- nineteenth- and early-twentieth-century instruments and remodeling of interwar instruments in a way that combined traditional dispositions with aesthetic advances in manufacturing. In the view of Canadian organist and historian Bouchard, the modern Canadian organbuilder does not rely on the "multiplication of gadgets," but a rigorous and balanced ideal.

As in other countries, the REED ORGAN became the preferred instrument for the Canadian home beginning in the mid-nineteenth century. Although the first "melodeons" used the air compression (pressure) principle (up to 1865), the "American organ" (based on suction) gradually became dominant type, with two horizontal bellows operated by foot treadles. In the 1870s, the cabinet-type case replaced the square case, with vertical bellows and drawstops located over the keyboard. The instrument reached its zenith in 1870–1910; the tendency toward standardization affected reed voicing, and cases became even more like late Victorian furniture. Ironically, some firms built two-manual models for church or orchestral use; these required a second person to pump a handle to wind the instrument. The reed organ went into decline when the player organ (or piano) became popular in the early twentieth century; records and radio completed the process, and most companies were out of business by the Great Depression. The last major firms closed in the 1960s.

RICHARD KASSEL

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CARE AND MAINTENANCE OF PIPE ORGANS

The care of a pipe organ consists of maintaining proper standards of tuning, mechanical operation and reliability, climatic conditions, and insurance.

The pitch of an organ flue pipe changes approximately 1.5 cents (hundredths of a semitone) with each degree Fahrenheit; this change is a factor of the changing density of the air inside the pipe. Lowering temperature (increasing density) lowers pitch; raising temperature (decreasing density) raises pitch. Because of the minute size of air molecules, the largest and smallest pipes in the organ change pitch at essentially the same rate—in other words, the ratio of the size of the molecules to the size of the pipes does not change appreciably.

Reed pipes do not change pitch with temperature at the same rate as flues because their pitch is determined primarily by the length of the vibrating tongue, not the length of the column of air. Because there are fewer reed stops than flue stops in most organs, the tuner typically tunes the reeds to the rest of the organ. Periodic corrections to the temperament are necessary, and flues are tuned to the temperament as needed.

Given the reliance of pitch on temperature, a basic tuning schedule in a temperate climate will include at least one visit at the onset of cold weather, and another for warm weather. Most visits are considered "touch-ups," as it can take several days to tune an organ of moderate size fully and accurately.

The complex mechanical functions of the organ are to be kept in accurate regulation to ensure maximum musicality; the machine should not be allowed to conflict with musicianship. The touch, weight, and travel of individual keys, strength of action springs, and "pluck point" (the precise point in the key's travel where the action is activated) must be consistent to ensure even scales. Mechanical failures can result in dead notes (the affected note will be missing from melodies and chords) or ciphers (a note that continues to play uncontrollably). Depending on the type of action, a dead note or a cipher may affect just one stop, a group of stops, or all of the stops on a given keyboard.

Maintaining proper climatic and physical conditions is essential to the operation of an organ. An organ will be in tune at the temperature at which it was tuned, even if the temperature has changed in the meantime. However, sudden and dramatic temperature changes will have negative affects on tuning. Maintenance of consistent and moderate levels of humidity is ideal; excessive dryness or moisture will have negative affects. While maintenance of the roof and windows near the organ seems an obvious need, many instruments sustain serious damage during storms or spring thaws.

The cost of building and repairing pipe organs requires that appropriate levels of insurance coverage be maintained. A service technician or organbuilder can advise the owners of an instrument concerning current replacement value. Without proper insurance, it may not be possible to affect high-quality repairs in the case of significant loss due to fire or other catastrophe.

See also **Chiff; Run**

John Bishop

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CARHART, JEREMIAH (1813–1868)

American inventor and reed organ builder. Born in New York in September 1813, Carhart was one of the most creative and innovative men to contribute to the American REED ORGAN industry. His first tentative efforts involved the accordion, the first of which he built in 1836; by 1839 he had developed and built a lap organ. He was employed by the American reed organ manufacturing firm of George A. PRINCE (1818–1890), where he built his first melodeon. It was here that he developed a suction bellows, for which he obtained a patent in 1846. Unknown to him, the concept had been patented as early as 1818 by A. M. Peaseley of Boston, and others had built instruments using the same principle. Carhart sold rights to manufacture organs under his patent to various makers, including his own employer, and the suction bellows gained in popularity until it dominated the entire reed organ industry. Carhart surrendered his patent twice for the purpose of making changes in it; in the course of a lawsuit against Charles C. Austin for infringement, a copy of Peaseley's earlier patent came to light; Carhart's claim was declared void. Of great significance among Carhart's other inventions was a machine for mass-producing reed boards, which, although patented by him, does not appear to have been an original concept.

In 1846 Carhart joined with Elias Parker Needham to form Carhart and Needham in Worcester, Massachusetts. The firm moved to New York in 1848, moving periodically within the city. A third partner, Samuel C. Swartz, joined the company in 1855, but died in 1865; Carhart died a few years later, in New York on 16 August 1868. In 1880, Needham sold his patents and retired from the business.

The company made reeds for the trade as well as complete organs. By 1866 the firm had built fifteen thousand organs and was producing instruments at the rate of forty per week. The largest had two manuals and pedals, with fourteen ranks of reeds, including a Pedal stop of 32' pitch. The firm was succeeded by the Needham Piano and Organ Company of Washington, New Jersey, with offices in New York and an output of seventeen thousand organs annually in 1897. The company was the maker of the Beethoven Organ.

James Howard Richards

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CARIBBEAN

See CENTRAL AND SOUTH AMERICA

CARILLON

A compound stop often found in larger organs built by Aristide CAVAILLÉ-COLL after 1878. Although the origin of the stop appears Dutch, it remains unclear how and when Cavaillé-Coll was introduced to the concept. The mixture invariably makes use of three wide-scaled ranks, either at 2-2/3', 1-3/5', and 1', or 2-2/3', 2', and 1-3/5'. The register can begin with all three pitches at CC, but the celebrated examples of the Carillon, notably at St.-Ouen, Rouen (Récit, 1890), and St.-Etienne, Caen (Positif, 1884), are progressive, beginning with the 2-2/3' at CC joined by the 1-3/5' and 1' at g.

The Carillon was invariably placed on secondary manuals, the Positif being preferred to the Récit. Charles MUTIN specifies that the Carillon is used to imitate bells and is drawn with a large-scaled Bourdon 8' and played staccato. Guilmant details a trio registration thus: "The Carillon is played in the top range of the manuals and with detached notes. In the left hand, a soft Trompette (Swell closed), supported by some Pedal notes, gives a pretty and light trio effect which, out of prudence, one will not overuse." The Carillon was highly useful in GRAND CHOEUR registrations, as Philbert attests, giving ensembles "brilliance due to the one-foot rank without breaks which enters in its composition. Hence, it is analogous to the German Scharf."

See also **Stop**

JESSE E. ESCHBACH

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CARLIER, CRESPIN (CRÉPIN) (D. 1636)

French organbuilder. Born in Laon, Aisne, of a family involved in organ building since the sixteenth century, Carlier apprenticed in Flanders, possibly to Jean Goduyn in Laon or Jean LANGHEDUL in Ypres. He was active in the early seventeenth century, initially in Courtrai, Dunkirk, Ghent, and St. Omer. This influenced his later work in France, specifically the Champagne, Isle-de-France, and Normandie regions.

In 1600, at the invitation of organist-composer Jehan Titelouze, he restored the organ of Rouen Cathedral, after which Titelouze used his services frequently. After working on the organs of St. Michel and St. Jean in Rouen in 1603, Carlier built instruments at Paris, St. Antoine (1606), Poitiers, Jacobin Convent (1607), Poitiers Cathedral (1610–13; repl. by Cliquot), and Rouen, St. André. He enlarged the Tours Cathedral organ (1611), worked on the Chartres Cathedral instrument (1614), and built the cathedral organ in Laon, his birthplace.

Carlier's most important instruments were built at Gisors (Eure), St. Gervais and St. Protais (reb. Barbier organ, 1618, destr. during World War II); Aisne, St. Quentin, Basilica (rest. 1620); and Rouen, St. Ouen, 1629 (case survives; expanded Cavaillé-Coll, 1890; retains 40 percent of orig. pipework). Carlier worked in Paris from 1631 on, collaborating with Langhedul on the innovative instrument of St. Jacques de la Boucherie.

Carlier typifies the movement of ideas from north to south, with innovations that would fundamentally modify the late Gothic or Renaissance organ: (1) splitting the PLEIN JEU into two stops (e.g., Fourniture, Poitiers Cathedral; (2) adding a *clavier à boucquin*, a separate keyboard and soundboard for the Cornet; (3) adding a Tierce 1-3/5 to the Plein jeu (Paris, St. Nicolas des Champs, 1632); (4) introducing the Grosse Tierce 3-1/5 (St. Jacques de la Boucherie) in association with a 16' Bourdon; (5) using the Flûte Allemande (a 4' stopped chimney flute) for variation in timbre; (6) introducing the Sifflet 1' or Flageolet (St. Jacques de la Boucherie); (7) adding the 4' Clairon to reinforce the chorus reeds (as did Langhedul); (8) transforming the sixteenth-century Régale into the Voix Humaine (Poitiers Cathedral); and (9) introducing the Flûte Traversière stop from Germany and northern Europe (Rouen Cathedral).

JEAN-RENAUD ANSART

CHRISTOPHER HAINSWORTH

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CASAVANT FRÈRES

The oldest active organ-building firm in Canada. Organbuilder Joseph Casavant (1807–1874) encouraged his sons [Joseph] Claver Casavant (1855–1933) and Samuel [Marie] Casavant (1859–1929) to take up the profession, but they did not succeed him immediately when he retired in 1866. Claver worked for his father's successor, Eusèbe Brodeur (1874–78), then apprenticed with John ABBEY in Versailles for a year. Samuel joined him in Europe, and they toured western Europe, viewing organs and workshops. They returned in 1879 and formed Casavant Frères in St. Hyacinthe, near Montreal, where the firm remains. The firm, which made its own pipes from the outset, followed the French Romantic principles of Aristide CAVAILLÉ-COLL, avoiding the more symphonic elements of the nineteenth-century organ. The firm began by building tracker organs, but these declined in importance and were no longer made by 1905. The firm's rise to near-total domination of the Canadian market stemmed in part from its interest in innovations such as the adjustable combination pedal (1880), tubular action (1884), electro-pneumatic stop action (1891), electrically controlled combination pedals (1892), adjustable combination action (1885), and fully electro-pneumatic action (1898). From then on until 1924, Casavant reserved electro-pneumatics for its larger instruments; by 1944, all Casavant instruments used electro-pneumatic actions.

The firm, which had built 1,355 organs by 1929, spread from its initial Quebec base to cover Canada from the Maritimes to the Yukon and British Columbia by 1907. Its first sale to the United States (Massachusetts, 1895) signaled the start of an even larger market. Among its international markets were France (where testimonials from organists were impressive and persuasive), India, Japan, South Africa, South America, and the West Indies,. But even this success could not forestall the effects of the Great Depression. Budget restraints led to standardization of stops; changes in taste led to more orchestrally imitative stops, a less substantial Positiv, and voicing favoring fundamentals over harmonics. An electro-pneumatic Romantic instrument for Quebec, St. Roch, 1942–43 (rest. Casavant, 1995) symbolized the company's tentative steps into the NEOCLASSICAL ORGAN, but when Canadian organists and academics developed serious interest in the European ORGAN REFORM MOVEMENT in the 1950s, Casavant and other older firms did not respond immediately.

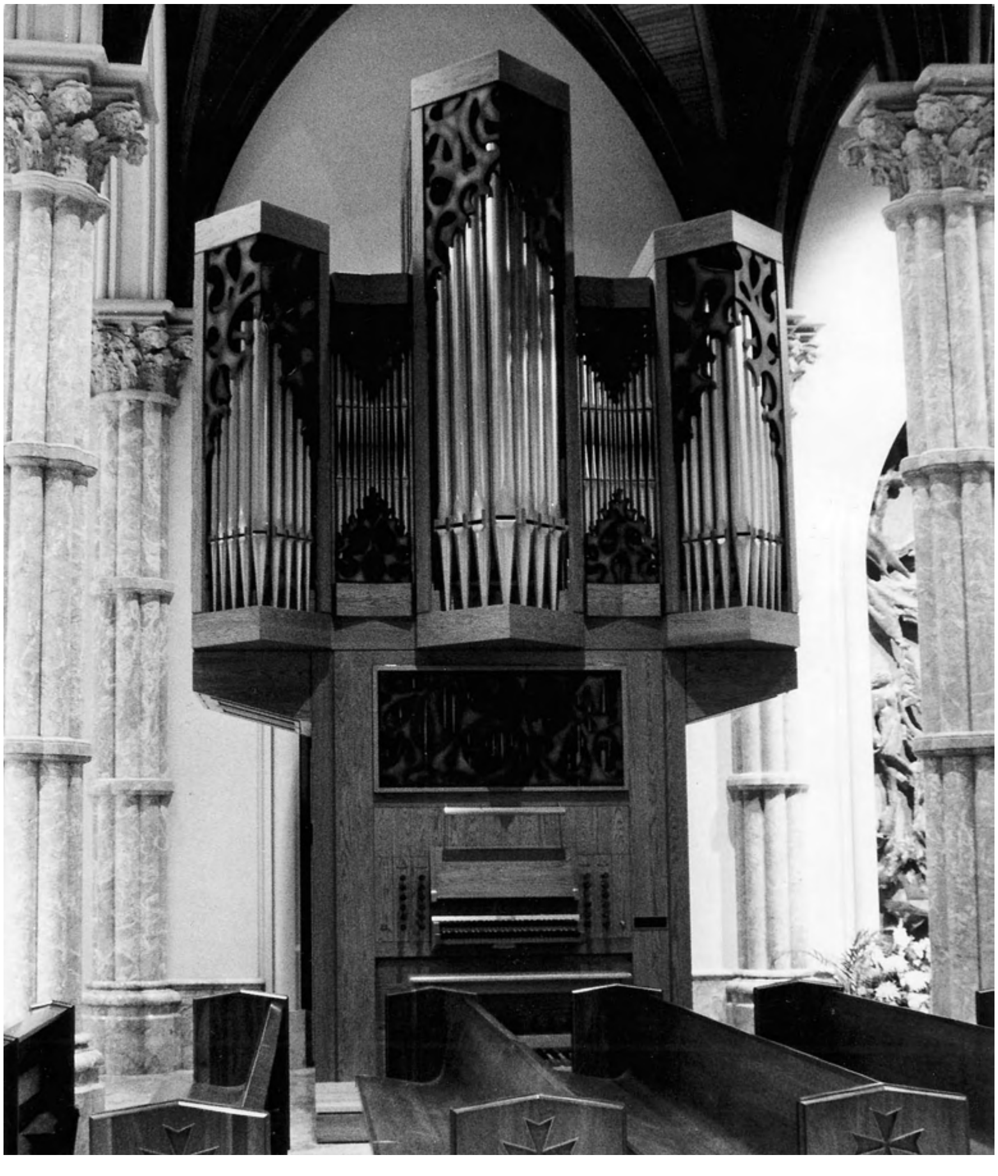

Fig. 22. Casavant Frères organ, op. 3537 (2/19), Holy Name Catholic Cathedral, Chicago, Illinois

The Canadian neoclassical wave proved to be more than a passing phase; Casavant, under the direction of its president, Charles Perrault (1956–81), and tonal advisor (later director) Lawrence I. PHELPS (1958–72), brought in three Europeans to help bring it up to speed: Karl WILHELM, who arrived in 1960; Hellmuth WOLFF, in 1963; and Gerhard BRUNZEMA, in 1972. Each in turn would leave to start his own firm: Wilhelm in 1966, Wolff in 1968, and Brunzema in 1979. Casavant continued to build its large electro-pneumatic instruments (Quebec, Saints-Martyrs-Canadiens, 1959), but built its first two-manual tracker revival organ in 1961. Casavant's status as a serious proponent of change emerged with the Phelps/Wolff instrument at St.-Pascal de Kamouraska, Quebec (1964). Its eclectic SILBERMANN-like disposition fulfilled the goals of neoclassicism, while the use of tracker action demonstrated the influence of Rudolf von BECKERATH's Montreal neoclassical organs.

Under the directorship of Jean-Louis Coignet since 1981, Casavant continues to build tracker organs; but it relies on electro-pneumatic action for its larger instruments with neoclassical dispositions, such as the four-manual instruments at Ottawa, Dominion-Chalmers United, 1964; and Calgary, Centre for Performing Arts, Singer Concert Hall, 1986 (4/75). The recent neoromantic revival has benefited Casavant (as well as its competitors); it is very actively restoring its own instruments, including Montreal, Notre-Dame Basilica, 1885–91 (1991); Montreal, Très-Saint-Nom-de-Jésus, 1915 (gallery and chancel organs; 1986–99); and Toronto, Metropolitan United, 1930 (largest organ in Canada; 1998). Casavant remains one of North America's largest organ-building firms; 80 percent of its organs go to U.S. locations.

Other Canadian builders have gone through the Casavant career path. Fernand LÉTOURNEAU worked with Casavant (1965–78), then set up Orgues Létourneau Ltée. in Ste.-Rosalie (1979; moved to St. Hyacinthe, 1984). The complicated history of GUILBAULT-THÉRIEN began with Providence Organ Co. (St. Hyacinthe), founded by Maurice Guilbault (1903–69), a former Casavant worker. Shortly before his death, Maurice ceded control of the firm to his son André, who had joined in 1955. In 1968, André brought in another former Casavant employee, Guy Thérien, to form what became Guilbault-Thérien in 1978. Santoire (Quebec), founded in 1975 by a grandson of a Casavant worker, specializes in Casavant restorations.

See also **Canada**

JAMES H. COOK

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Casavant Frères. <http://www.casavant.ca/>.

CASE

(Fr. *buffet*) The architectural enclosure or housing, or shell that incorporates the CONSOLE, CHESTS, ACTION, WINDCHESTS, and PIPES of an organ. The case is open to the front and (usually) freestanding; it provides an opportunity for skilled carpentry and artistic expression (according to the period). The traditional case consists of various kinds of seasoned hardwood (depending on availability, cost, building interior, environmental conditions, builder preference, etc.), constructed using nails, cleats, or, at its most sophisticated, glue-based joinery. The case, the physical realization of the organ as instrument may be distinguished from its FACADE, the ordering of the pipes within each chest (resonating chamber), and the gilding, painting, architectural treatments, and sculptural ornamentation applied. Historically, both would come to be highly elaborate symbols of status (whether ecclesiastical, courtly, or municipal) and reveal much about the overall architectural and design aesthetics of a given location or era.

Less apparent is the case's relevance to organ ACOUSTICS, with an essential role in the projection of pipe sound. Cases serve two functions: (1) they contain a set of chests by which the sounds produced by different ranks of pipes may blend with one another; and (2) they provide a means for projection of the sound of the pipes, traveling out into the room (and therefore the audience) through the opening in the front of the case. The sides, back, and top of the case must be made of a reflective material in order that they can serve this function.

The building itself may have a major impact on the instrument, which might be placed behind a squared, rounded, or pointed apse or chancel arch, or be separated from the main body by a screen. The presence of other elements as well as windows (especially stained glass) requires the builder to adapt to these conditions also. The case and its sections may reinforce the already present architectural qualities and colors of the building, with variations on arch, lozenge, and quadrangle providing the essence of design elements for the case as a whole.

The traditional design of a case depends on symmetrically placed sections or compartments, each of which houses a chest in which pipes are placed. In the so-called WERKPRINZIP approach to building organs, each DIVISION may have a single chest or group of chests (or PEDAL TOWER); in other cases, a division may be spread among several chests. In some instruments, chests were added to older instruments to reflect increased tonal capacity and number of divisions. Not all of the functional pipes are visible from the front; on the contrary, some facades comprise mostly DISPLAY PIPES. In the post–World War I era, the overwhelming reaction to the gigantism of the nineteenth century and postromanticism left its mark in organ building via modernist case designs that owed much to Bauhaus and other "streamlining" aesthetics. Symmetry lost its absolute hold on design; divisions might be entirely exposed. In tandem with the authenticity movement of the last half of the twentieth century, the focus has shifted from the exterior to the interior of the instrument, apparently realizing Henry Willis's doctrine that money is better spent on stops than on cases.

In the late nineteenth century, builders began placing organs in chambers separate from the console and "walled in," yet open to the space in which the organ was meant to be heard. The facades of these were architecturally independent of the disposition of the pipes, which might be hidden by grilles and invisible to the audience. In other cases, screens or pseudo-facades would reveal some pipes, but they would still rest in another room. The continuation of this practice has been discouraged by latter twentieth-century concerns about the disruption of sonority by architectural elements.

See also **Cleat**

Richard Kassel

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CASPARINI (CASPARI)

Organ-building family active in Silesia, Upper Italy, East Prussia, Lithuania, Poland, and the Tyrol in Austria. The name is also rendered as Caspar and Gasperini. Adam Caspar I (b. ca. 1590; d. after 1665) was an organbuilder and mathematician in Sorau (Zary, Poland). He was a pupil of Marx Günzer (d. 1628) in Augsburg.

Eugenio (Eugenius, Eugen) Casparini (chris. Johann Caspar) (b. Sorau, 14 Feb 1623; d. Niederwiesa/Greiffenberg [Gryfow Sl[sl]aski], 12 Sept 1706) was the son of Adam Caspar I. He presumably learned the organ-building trade from his father; at about age sixteen he went to work at the court of the prince-bishop of Regensburg. In about 1642 or 1643 he went to Venice, where he served the doge and republic for thirty years (S. Giorgio Maggiore; now in Isola). He also worked as an organist and organbuilder in Gorizia, Friuli, for about ten years (Trieste, Cathedral of S. Giusto, 1656–59). At some point, he adopted the Italian versions of his given and family names and converted to Catholicism. In 1661–62 he rebuilt the four organs in the Basilica of S. Antonio in Padua, and became responsible for the maintenance of them. In 1672 he journeyed to Vienna at the invitation of Emperor Leopold I, where he worked on the court organs and made a positive with paper pipes for the palace. In 1674 he was again in Padua (S. Giustina; Epistle organ, 1679; Gospel organ, 1681); in 1686–87 he worked on the instrument at Trento, S. Maria Maggiore (incorp. 1554 Grandi case; played by George Frideric Handel, 1707). After 1688, he lived in the South Tyrol, where he had workshops, first in Eppan (St. Paul's, 1688), then Brixen (now Bressanone, Italy; Cathedral, choir organ, 1690). In 1697, at the age of seventy-four, he returned to his homeland, where he built the "Sonnenorgel" for Görlitz, St. Peter and St. Paul (1697–1703; case survives); he also returned to his Protestant faith.

Eugenio Casparini was a gifted and ingenious organbuilder whose instruments adopted the Italian approach to specification, with the addition of several flutes and a variety of reed stops. His instruments included flue Cornets, undulating stops, high-pitched mutations, and reeds. In the course of his work he experimented with elements of technical construction; but the realization of those technical components did not always keep pace with the ideals he envisioned, and complaints were not uncommon.

Adam Orazio (Horacy, Horatius) Casparini (b. Padua, 29 July 1676; d. Breslau [Wrocl[sl]aw], 18 Aug 1745), the son of Eugenio Casparini, followed his father back to Silesia; they worked together in Hirschberg (Jelenia Góra), and completed Eugenio's last instrument (Hirschberg, Catholic parish church, 1706; case survives). After his father's death, Adam Orazio settled in Breslau. His early instruments were criticized for hasty construction and often needed repair. Later instruments, however, reflected careful and excellent craftsmanship, and generally had impressive casework. His organs include Breslau, St. Bernhardin (1709); Ohlau (Olawa), Stadtkirche (1712); Breslau, St. Elisabeth (1715, choir organ in Kammerton, rest. 1999); Wohlau, Carmelite abbey (1716; reb. G. B. Engler, ca. 1781); Tschenstochau (Jasna Góra) (1721–25, three instruments); Wahlstatt, Abbey (1731); and Breslau, Church of the Eleven Thousand Virgins (1735).

Adam Gottlob Caspari (b. Breslau, 15 April 1715; d. Königsberg, Prussia [Kaliningrad, Russia], 13 May 1788), the son of Adam Orazio Casparini, is the same person as Dominik Adam Casparini. He apprenticed with his father in Breslau, spent six years as a journeyman in Saxony and Thuringia, and worked with T. H. G. Trost in Altenburg (1735–37). Working with his father, he built the organ in the Dominikanerkirche in Glogau. In 1742 he was appointed the court organbuilder in Königsberg, the successor of his cousin George Siegmund Caspari (see below). He is known to have built forty-four organs, particularly in East Prussia, Lithuania, and Poland. His specifications incorporated colorful 8' stops such as Unda Maris, Hohlflöte, Salicet, and Quintatön, and the Pedal often utilized a Füllbass 10 2/3'. Toy stops included the Prussian flying eagle (with movable wings), and a Glockenspiel. Among his instruments are four in Königsberg: Altrossgärter Kirche (1747–52; 2/26); Tragheimer Kirche (1744–52; 2/30); Haberberger Kirche (1752; 3/48); and Altstädtische Kirche (1763; 3/65); and Heiliger Geist, (II/31, 1776; 2/31), as well as Vilnius (Lithuania), Church of the Holy Spirit (1776). Seventeen original contracts with specifications, photographs of organ facades, and organs in Mühlhausen (Mlynary) near Preussisch Holland (1742), Leunenburg (1745), and Barten (1750) are preserved. His pupils included Johann Preuss, who built some thirty instruments in East Prussia and became a competitor, and Christoph Wilhelm Braveleit, who later took over Caspari's workshop. His only son, Adam Eugen Caspari, matriculated in the University of Königsberg in 1786 as *organorum musicorum fabricatore*, but nothing is known of his organ building.

The work of the next four family members is less well known. Ignaz Casparini, another son of Adam Orazio Casparini, also built organs, and was active in Breslau in 1744. Georg Adam Caspari I (b. Sorau, 1631; d. there, 8 July 1682), another son of Adam Caspar I, was an organbuilder and maker of instruments. It is known that he renovated the organs in Liegnitz (Legnica), SS. Peter and Paul (1659), and Sorau (1669–70). His son, Georg Adam Caspari II (b. Sorau, 1662; d. there, 28 June 1736), built an organ for Halbau (Ilowa) (1705) and repaired the organ at Jauer (Jawor), Friedenskirche (1709). Johann Michael Caspari (b. Sorau, 11 Sept 1674; d. there, 8 November 1713), another son of Georg Adam Caspari I, was an organbuilder and pewter caster.

Georg Siegmund (Sigismund) Caspari (b. Sorau, 17 May 1693; d. Königsberg, 7 April 1741), representing the fourth and final generation of Casparini organbuilders, was the son of Georg Adam Caspari II. In 1721, he began working with Johann Josua MOSENGEL, participating in the building of the Königsberg cathedral organ (1721, III/62), and marrying Mosengel's daughter in 1729. From 1731 to 1741 he succeeded Mosengel as organbuilder for the Prussian Court in Königsberg. He is sometimes incorrectly referred to as Adolf Gottlieb Casparini. Some of his organs include three in Königsberg: the Reformierte Burgkirche (1726; 2/27), Schlosskirche (1732; 2/29), and Neurossgärter Kirche (1737; 2/32).

DOUGLAS E. BUSH

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CAUS (CAUX, CAULX)

SEE SALOMON DE CAUS (CAUX/CAULX)

CAVAILLÉ-COLL, ARISTIDE (1811–1899)

The most important nineteenth-century French organbuilder, and one of the most influential organbuilders of any century. Cavaillé-Coll developed new technologies and introduced new concepts of tonal design to French organ building. In doing so he established a new type of organ in France—one that has inspired composers of organ music for over 150 years.

Cavaillé-Coll, born in Montpellier on 4 February 1811, began his career by doing his apprenticeship with his father. At age nineteen he worked in Spain, during which time he began to experiment with a new form of wind regulation. He also made an improvement in the way manual couplers worked, developing a pedal that allowed a coupler to be engaged without physically moving one of the keyboards. This ability to see deficiencies in organ technology and then to incorporate improvements—his own or those invented by others—characterized his work for the rest of his career. An improvement he made to the REED ORGAN resulted in an instrument he called a *poïkilorgue,* and it

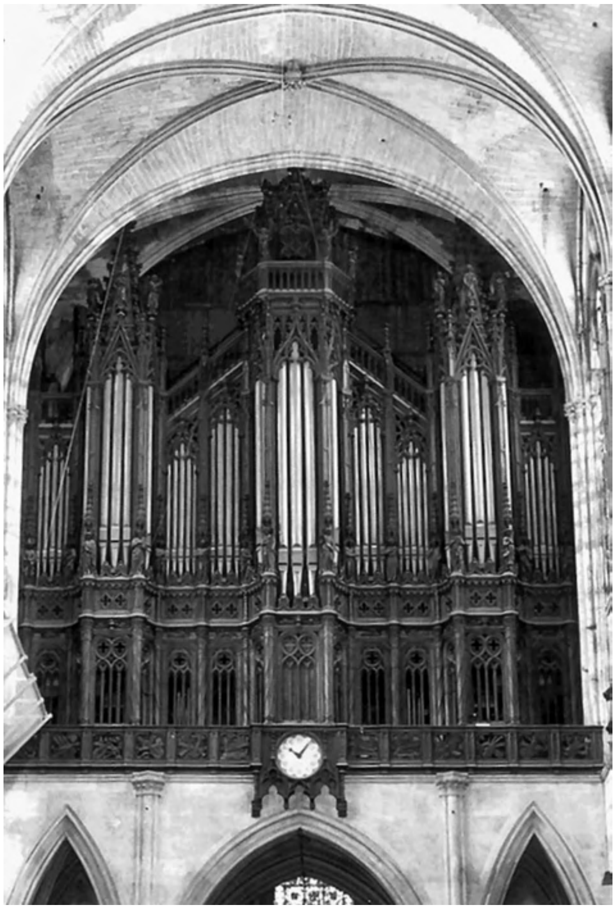

Fig. 23. Cavaillé-Coll organ, 1841 (4/70), St. Denis, France.

was the sound of that instrument that attracted the attention of Gioacchino Antonio Rossini in Toulouse in 1832. At the urging of his family and Rossini, Cavaillé-Coll went from Toulouse to Paris in 1833, his goal being to further the development of the family business in the capital.

It is a measure of Cavaillé-Coll's personal and business strength that, within only days of his first calling on musicians in Paris, the Cavaillé-Coll firm was awarded the contract to build a new organ for the medieval abbey of St. Denis (now St. Denis Cathedral). The completion of this instrument in 1841 (4/70) established Cavaillé-Coll's reputation, and official recognition of the quality of the organ led inevitably to more commissions. The new elements incorporated into the St. Denis organ, some of them carefully enumerated by Cavaillé-Coll himself in 1839, became standard features of his organs. In effect they constitute essential mechanical and tonal elements of the French Romantic (symphonic) organ, so this organ will be discussed as the prototype for a design that has influenced French organist-composers from that time until the present day.

The first mechanical improvement seen in the St. Denis organ is the use of the double-rise PARALLEL RESERVOIR, built along the lines Cavaillé-Coll had first investigated three years earlier in Spain. Because all sides move simultaneously and evenly, a constant weight produces a constant wind supply, rather than the flexible wind supply produced by the WEDGE BELLOWS of earlier instruments. Stable WINDING became a necessity in large instruments. Much of that wind was required by the high number of harmonic pipes in the St. Denis organ. Double-length stops, both flues and reeds, were bigger, bolder, and smoother in tone than their counterparts of normal length, and their use in nineteenth-century organs is a reflection of the general aesthetic of the time. These OVERBLOWING HARMONIC STOPS were not new, but Cavaillé-Coll's harmonic flutes were much more reliable and easier to control than earlier examples. These stops, however, required more wind than the simpler forms of most flutes, whether stopped or open in construction. In order to produce a constant volume from reed stops, Cavaillé-Coll even provided for higher WIND PRESSURE in their treble range, calling for even more wind in order to produce the appropriate volume of smoother reed sound in the higher pitches. His design for divided chests allowed higher wind pressures for both reeds in general and for treble ranges in particular.

Although the higher pressure allowed the development of stronger voices in the organ, it made the instrument difficult to play, as greater force was required at the keyboard in order to open the pallet. The wind pressures planned for St. Denis would have made it difficult to play even on a single manual; but the plan also called for manual couplers using the pedal mechanism developed while Cavaillé-Coll was in Spain. Given the wind pressures involved and the size of the pallets required to power the many harmonic stops, the organ would have been impossible to play with even two of its four manuals coupled together. In the last year of construction, Cavaillé-Coll made the acquaintance of Charles S. BARKER and incorporated his patented pneumatic levers in the St. Denis organ. BARKER LEVER action used the power of the wind pressure to open the pallets in the sound box. As adapted by Cavaillé-Coll, these levers not only allowed higher wind but also provided the power that permitted the organist to play when all manuals were coupled together. This produced an altogether new and powerful sound. The organist had only to provide force sufficient to open the relatively small pallet incorporated into the Barker lever; this "machine" then did the heavy work of opening the large pallets that allowed the pipes to speak.

Changing tone color through coupling different divisions might have been a sufficient improvement in a large instrument of the type built for St. Denis, but the instrument as finally built introduced the SWELL division, another new element that would have far-reaching effect on French organ music. The French classical Récit had been a half-manual only, its small number of stops beginning at c' and playing only in the treble range. Furthermore, even though enclosed divisions had been known and used elsewhere for more than a century, French organs had never employed this particular expressive device. The St. Denis organ had a full-compass *Récit expressif* whose stops were placed in a specially designed enclosure. Its sound-dampening walls were of sufficient thickness and construction to allow the enclosure to produce a greater difference in volume through the opening of heavy swell shades than had ever been possible with earlier Spanish or English examples.

In addition to the elements identified by Cavaillé-Coll, there are several other features of the St. Denis organ that distinguish it from its classical predecessors. A comparison of the stoplist reveals timbres characteristic of Cavaillé-Coll's later instruments, present here for the first time:

Grand-Orgue (GO; Manual II. C-f''')

Montre	32
Montre	16
Bourdon	16
Montre	8
Bourdon	8
Viole	8
*Flûte Traversière	8
*Flûte Octaviante	4
Prestant	4
Nasard ou Quinte	2-2/3
Doublette	2
Grosse Fourniture	IV
Grosse Cymbale	IV
Petite Fourniture	IV
Petite Cymbale	IV
Cornet (mounted)	V
*I Trompette	8
*II Trompette	8
Basson(bass)	8
Cor Anglais(treble)	8
*Clairon Octaviante	4

Récit (expressif) (REC; Manual IV. C-f''')

Bourdon	8
*Flûte	8
*Flûte	4
Quinte	2-2/3
*Octavin	2
*Trompette	8
*Voix Humaine	8
*Clairon	4

Pédale (C-c'; reeds: F-f')

Flûte Ouverte	32
Flûte Ouverte	16
Flûte Ouverte	8
Gros Nasard ou Quinte	5-1/3
Flûte Ouverte	4
Basse-contre(24)	16
Bombarde(24)	16
Basson(12)	8
I Trompette(12)	8
II Trompette(12)	8
I Clairon(6)	4
II Clairon(6)	4

Positif (POS; Manual I. C-f''')

Bourdon	16
Bourdon	8
Salicional	8
*Flûte (open)	8
Prestant	4
*Flûte Octaviante	4
Bourdon	4
Nasard ou Quinte	2-2/3
Doublette	2
*Flageolet	2
Tierce	1-3/5
Fourniture	IV
Cymbale	IV
*Trompette	8
Cor d'harmonie(bass)	8
Hautbois(treble)	8
Cromorne	8
Tremblant	8

Bombarde (BOM; Manual III. C-f''')

Grand Cornet	VII
Bourdon	16
Bourdon	8
Flûte	8
Prestant	4
Nasard ou Quinte	2-2/3
Doublette	2
Bombarde	16
*I Trompette	8
*II Trompette	8
*I Clairon	4
*II Clairon	4

Combination pedals:
REC-GO, BOM-GO, GO-GO, POS-GO
Swell
High-pressure basses; high-pressure trebles
Sub-octave (all manuals)
Pedal couplers (all manuals)
Heavier wind on harmonic and reed stops

Perhaps the most important new sound is found in the incorporation of string stops in the disposition: the Viole on the Grand Orgue and the Salicional on the Positif. Their inclusion, along with the presence of harmonic (double-length) flutes, essentially changed the old concept of the *fonds d'orgue* and created a new ensemble. Hereafter, FONDS in a French score indicated the use of four flues on each manual: Montre, Bourdon, Flûte (Flûte, Flûte Harmonique, or Flûte Traversière), and a string (Gambe, Viole, Viole de Gambe, or Salicional). Harmonic flutes at 8', 4', and 2' pitches in the Récit constitute another characteristic trait, one that influenced much of the music of later composers. The presence of Trompettes on each division was not completely new, even though the sound of these harmonic trumpets was significantly smoother and stronger than earlier examples. Putting the Voix Humaine on the Récit was new, though, and its inclusion in the enclosed division is another sound that is essential in playing much later music. A cylindrical reed on the Positif, here a Cromorne, is the equivalent of the Clarinette on later instruments.

Some characteristics of this instrument are, or course, in the classical tradition, and indeed they remained a characteristic of Cavaillé-Coll's later organs as well. Most notable is the presence of Principal choruses of contrasting pitch levels through mixtures on Grand Orgue and Positif. In later instruments, it was more typical for Cavaillé-Coll to use the newer PLEIN JEU rather than the two mixtures (Fourniture and Cymbale) of older instruments, but it is quite rare to find a three-manual instrument without a mixture of some type on both Grand Orgue and Positif. Another traditional characteristic is the limited number of stops in the Pédale division, a trait that is typical of almost all of his instruments. Other characteristics of earlier organs, such as the *ravalement*, the downward extension of the Pédale reeds to pitches lower than the manual compass, are seen here for the last time.

After his initial success, Cavaillé-Coll continued to experiment and refine the concepts seen in this instrument. Perhaps the most notable change in later instruments was the exchange of Positif and Grand Orgue manuals. In this arrangement, the Grand Orgue became the first manual (nearest to the player). The addition of stops using pedal movements, in combination with divided chests on each division, allowed a player to create a crescendo without drawing stops by hand or relying on assistants to do so. This characteristic itself influenced composers and their conception of music for the organ, because a new type of crescendo was available, one that can be found in the music of composers from César Franck to Naji Hakim.

All in all, Cavaillé-Coll built instruments that can be found today in their original and unaltered states as well as many that have been modified several times over the past one hundred or more years. Even when the instruments have been significantly altered, the genius of their creator is still evident. A short list of some of the other Cavaillé-Coll organs in Paris, along with the organist-composers who have been associated with and influenced by these organs, is perhaps the best way to comprehend the degree to which these instruments have set the course of French organ music for over 150 years:

La Madeleine (1846; Lefébure-Wély, Saint-Saëns, Dubois, Fauré, Demessieux).
Ste. Clotilde (1859; Franck, Tournemire, Langlais). (For the complete specification of this instrument, see Anches.)
St. Sulpice (1862; Widor, Dupré, D. Roth).
Notre Dame (1868; Vierne, Cochereau).
La Trinité (1869; Guilmant, Messiaen, N. Hakim).
St. Etienne du Mont (1873; Duruflé).

It is difficult to imagine their music without an instrument that has the characteristics first seen in the St. Denis organ and later refined in the nearly five hundred organs Cavaillé-Coll completed before his retirement in 1890. He died in Paris on 13 October 1899.

JAMES H. COOK

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CELESTA/CHRYSOGLOTT

A percussion stop intended to imitate the orchestral instrument of the same name. It consists of a set of metal plates struck by hammers that are actuated by a pneumatic or electric mechanism. The plates are sometimes placed over resonators. It is usually found at 4' pitch, and is often of short compass, though some examples extend to a full 61 notes. It is sometimes found under the name "Harp," and is often found on theater organs as a Chrysoglott.

SEE ALSO **STOP**

EDWARD L. STAUFF

CELESTE/CÉLESTE/SCHWEBUNG

(1) A string-toned stop of varying scale purposefully detuned (sharp) to the unison pitch of the organ to produce a shimmering effect, which should be called Voix Céleste or Vox Celeste.

(2) Any stop, almost invariably enclosed, purposefully detuned to the unison pitch of the organ to produce a shimmering or "celestial" effect when drawn together with a pure-tuned stop. The German *Schwebung*, commonly used for the finger vibrato on the clavichord, here denotes the detuning effect of pipes. The principle employed is that which produces resultant tones, albeit for a different effect. Celestes are generally found at 8' pitch, but 4' pitch examples are common and 16' pitch examples are known to exist. The only known example of Superoctave and mutation Celestes is that of the "Wanamaker organ" in Philadelphia, where examples at 5-1/3', 3-1/5', 2-2/3', and 2' pitch are found in the string organ under the name Violina.

There are various kinds of Celestes. The Voix Céleste is constructed of strings (usually narrow-scale) comprising one to three ranks with one rank tuned sharp to the unison or, in the case of two or three ranks, one tuned sharp, the second tuned either pure or flat, and the third tuned flat. The Flûte Celeste is constructed of open flutes consisting of one to two ranks with the rank tuned flat to the unison in the case of a single rank or, in the case of two ranks, one tuned pure and the other tuned flat. Other Celestes can built derived from stopped Flutes (Unda Maris), String hybrids or Flute hybrids, Diapason hybrids, or (very rarely) Diapasons (Piffaro, Voce Umana); they generally do not descend below tenor c, although exceptions are known to exist.

See also **Stop**

EDWARD L. STAUFF
DAVID SMIT

CELESTINA

A term used for a variety of stops. The name was introduced by William HILL around 1860 for a soft, small-scaled open wooden FLUTE of 4' pitch. The same name was later used by Henry WILLIS for a 4' open metal stop of small scale and somewhat louder tone. It was used in nineteenth-century American organs for a 4' string; George AUDSLEY called it an octave Dulciana; Robert HOPE-JONES used the name for a type of Quintaton celeste.

See also **Stop**

EDWARD L. STAUFF

CENT

A unit of measure for musical intervals. One cent is 1/1200 of a pure octave (an octave with a frequency ratio of 2:1); hence a semitone equals 100 cents. The term was introduced by Alexander Ellis in the 1860s, but the necessary mathematics had been worked out in manuscript by Isaac Newton in 1665.

See also **Tuning and Temperament**

MARK LINDLEY

CENTRAL AND SOUTH AMERICA

This entry includes Caribbean countries, the former British Honduras (Belize), and other non-Iberian areas, including the Guianas on the northern shore of South America. All other countries on this continent are the result of either Portuguese (BRAZIL) or Spanish (all others) colonization, beginning in the sixteenth century. During the period, areas such as Nueva Spain (the area north of modern Panama), Nueva Granada (now Colombia, Panama, and VENEZUELA), "New Portugal" (Brazil), Cuzco (Bolivia, CHILE, Peru), and La Plata (Argentina, Paraguay, Uruguay) received the close attention of adventurers, the Roman Catholic Church, royalty, and entrepreneurs from the home countries. After most of the continent broke free and formed independent nations in the nineteenth century, important cities grew impressively with the support of the wealthier descendants of European settlers; indigenous people moved to the urban areas to earn a living.

To a greater degree than North America, native South and Central Americans remained isolated from European influence, thanks to extreme geographical and cultural differences. Politically, feudal dictators who maintained strong economic ties to Europe ruled the area. In the case of South America and Central America (excluding MEXICO), this connection led to the importation of numerous organs, especially from Aristide CAVAILLÉ-COLL and German builders in the later nineteenth century and beyond. While Mexico's history parallels the rest of Latin America's, it developed a more successful local organ-building trade.

South America

As Andrés Günther has noted, the Iberian Americas have a strong church-oriented organ tradition rather than a history of concert performance, a situation that has rarely been challenged. From the earliest years of colonization, the church brought in missionaries who brought with them portatives (in some cases, positives) to support the singing of Latin hymns by indigenous people; in some cases, the priest learned the local language and translated the hymns, or taught Spanish or

Portuguese using this musical tool. Later, like their European colleagues, local composers contributed excellent music to those churches that could afford a chorus. The organ performed in a continuo role, not as a performance vehicle; churches were not considered part-time concert halls.

As Iberian America became a source of wealth with the exploitation of its natural resources, more foreigners settled, bringing their taste for more elaborate display of religion, whatever the degree of their faith. The large instruments of the day were imported from Iberian builders and followed Iberian Baroque style, with its characteristic horizontal trumpets. In Venezuela, Bishop Mariano Martí (1721–1792) wrote in the 1780s of organs at the Caracas cathedral and the church in Lesama. Argentina's first known church organ, a seventeenth-century, Iberian-style one-manual, probably came from the old Cuzco/Peru region. In the eighteenth century, Argentina received European instruments, all anonymous: the choir organ of Buenos Aires Cathedral, an organ in that city's Santa Catalina de Siena, and, in Cordoba, an instrument now kept at the Museo Historico Marques de Sobremonte. In Bolivia, the "silver rush" city of Potosí was at that time the largest in all of South America. (Minas Gerais, Brazil, was another "boomtown.") The convent of Santa Mónica in Potosí had an organ by the end of the seventeenth century (rest. E. A. Godoy, 2001–2). In La Plata (now Sucre), the Spanish builder Sebastián de León built organs for the Cathedral of Santo Domingo and the Augustinian monastery of Nuestra Señora de Remedios. Two centuries later, Pedro Matos built an instrument for the convent of Santa Clara, Potosí (1792; rest. P. Quoirin, 1997). In the Colombian city of Extremadura, S. Martín has a Baroque organ built by Antonio de Larrea y Galarza (1759–62). In Paraguay, Asunción was the site of an important Jesuit mission; the rector of the mission's seminary of San Miguel commissioned an organ for its church from the German builder Kratzer (1753).

After the revolutionary movements led by Simon Bolivar, José de San Martín, and others led to the liberation of vitually the entire continent from European rule in the first part of the nineteenth century, South Americans of Iberian origin grew wealthier; wishing to compete with their former European rulers, religious leaders and municipalities began spending increasing amount on organs, almost all of them imported from non-Iberian builders. (A major exception was the organ for the Cathedral of Santa Fé in Bogotá, by the Basque builder Aquilino Amezua y Jaúregui, 1891.) The notable lack of local enterprise in this area may be attributed to the absence of precedent, the lack of necessary skills and tools, the tropical and subtropical climates (which challenged European organ technology severely), and the encouragement of free trade between former colonies and their one-time masters.

British firms placed instruments in or near Buenos Aires: Forster and Andrews, BRYCESON (1864; now at Quilmes, All Saints; rest. Godoy, 2000), J. C. Bishop and Son, John ABBEY, and GRAY AND DAVISON. Other British firms were active in Georgetown, British Guiana (now Guyana): Henry WILLIS, HARRISON AND HARRISON, and Bevington (St. George's Cathedral, 1892, electro-pneum.; reb. Walker and Sons, late 1970s). Dutch builders were active in their own colonies: in Paramaribo, Dutch Guiana (now Suriname), Jonathan BÄTZ, MAARSCHALKERWEERD, and C. F. A. Naber installed instruments. Italian builders were active in Argentina: Celestino Balbiani, Carlo VEGEZZI-BOSSI, Giacomo Locatelli, Giovanni Tonoli (Buenos Aires, Nuestra Señora de Balvanera, 1875; rest. Godoy, 1994–95), and SERASSI (before 1868). In Bolivia, Tomás D. Santamaría built instruments in Tarata, Tarija, and Potosí, and repaired organs in Cochabamba.

The primary European sources for South American organs, however, were French and German firms. Buenos Aires and its environs received some twenty (mostly) tubular-pneumatic instruments from the French firm; however, its founder, Cavaillé-Coll, was personally responsible for only one, the Cathedral (1885–86, moved to Santa Fé, Nuestra Señora de los Milagros, 1887). Charles Mutin, who purchased the company from its founder in 1898, built all subsequent Cavaillé-Coll (later called Mutin–Cavaillé-Coll) organs for the capital city (Basílica del Sagrado Corazón, ca. 1906, 2/23) to 1924. Cavaillé-Coll himself supervised the building of organs for other countries: Argentina, Bolivia, and Brazil (twelve); Chile (ten); and Colombia, Peru, and Venezuela (seven). That a French builder would find such favor within an Iberian region probably reflects his instruments' great popularity in Portugal and (especially) Spain.

German builders were (and continue to be) the most active in South America; until recently, E. F. WALCKER was the predominant firm. According to Juárez, the Ludwigsburg company installed more than fifty instruments in Argentina, dating back to 1871 (and as recently as 1968); the vast majority of these are in or near Buenos Aires, with other instruments in Rosario and San Juan. In Colombia, Walcker installed at least ten instruments in Bogotá, including the forty-four-stop organ for the Institute (1925) and the organ for the Sala de Conciertos Luis Arango (1967; 3/33) with its modern uncased irregular pipe layout. The company installed instruments in twelve other locations, including Medillin (Colegio San José, 1956) and San Juan (Concert Hall, 1968). Paraguay's most famous organ is the pneumatic-action Walcker at Paysandú, Nuestra Señora del Rosario y San Benito de Palermo

(1906, 2/23; rest. Oberlinger, 1997). Other countries waited until after World War II to receive Walcker organs. Between 1953 and 1958, Venezuela received new Walckers in Caracas, Cumaná, Porlamar, and Rio Cabre. Uruguay has three Walckers, including Montevideo, Colegio y Liceo Santo Domingo (1956). Quito, Ecuador, has a concert organ Walcker (1962).

Other early German entrants in the South American organ world were R. Ibach (1905–9) and Wilhelm Sauer (Ecuador, Loja, Cathedral, 1892; rest. Oberlinger, 1994). After Walcker, LAUKHUFF was the most active firm; beginning in 1908, it placed over twenty-five instruments in Argentina, Bolivia, and elsewhere, mostly during the interwar period (Potosí, San Francisco, 1925; rest. Godoy, 2001). STEINMEYER and Strebel installed five organs in Bolivia between 1930 and 1935. Kurt Schmelzer, a German builder working in Venezuela, built two instruments in Caracas (1938). The Austro-Silesian firm RIEGER installed a few organs during that period (Buenos Aires, Basílica del Espíritu Santo, Nuestra Señora de Guadalupe, 1911; reb. 1983; now electro-pneum.); it reentered the market after World War I (1935–38).

World War II brought a halt to the importation of instruments from Europe. South America's economy suffered, resulting in the lack of capital necessary to maintain a quasi-European facade. One interesting result was the emergence of a significant Buenos Aires–born builder, Santiago E. Poggi, whose grandfather had repaired organs in the latter part of the nineteenth century. The younger Poggi built at least seven instruments for his home city (1943–50). His example set a precedent for younger builders like Enrique Alejandro Godoy (b. Buenos Aires, 1967), who trained in Europe. Godoy built an organ for Buenos Aires, Nuestra Señora de Loreto (1997–2001), using parts of the last Cavaillé-Coll organ installed in South America (1926). He has restored several European instruments in Argentina and elsewhere, and has become an important historian of South American organ building. Less successfully, Organería Española S.A. in Caracas built electric-action instruments in the 1950s that broke down too often because of technical problems. New building by foreign firms has slowed considerably; in 1990, the German firm OBERLINGER installed two one-manual instruments in Caracas. But a new trend, the digitally sampled organ, was introduced into Latin America by the Dutch firm Johannus, at Seventh-Day Adventist churches at the Universitaria del Río de la Plata (Argentina) and Centro Universitário Adventista (São Paulo).

Whatever climate, poor maintenance, world wars, and postwar economics have not already done to hurt the state of the pipe organ in South America, politics and the church have almost guaranteed its fate. The struggle between military, civilian, and rebel leadership became the norm in most countries, creating an instability that frightened off investors and invited neocolonization. One symbolic loss for the organ world was the destruction of the 1910 Mutin–Cavaillé-Coll organ at the basilica of San Francisco during rioting in Buenos Aires in 1955. Perhaps more damaging was the Vatican II reforms of the late 1950s. In most quarters of South America, the change to the vernacular and the broadened definition of acceptable praise music became interpreted as the opportunity to develop the so-called folk mass and to replace the organ with guitars and the like. While many consider this a misinterpretation of the Vatican II doctrines, the longstanding lack of maintenance for most South American organs could only have encouraged changing to instruments that could be built and cared for locally. The final blow has been the importation of electronic organs throughout Latin America; if, to some, the much lower cost of these instruments has clouded judgment on this matter (e.g., regarding the inevitable obsolescence and unavailability of replacement parts), then those who believe in maintaining the postcolonial pipe organ tradition have to bear responsibility for it. They continue to do so in major cities and religious settings, but are unable or unwilling to extend a hand elsewhere. In Peru, local builders copied for a long time the primitive Spanish instruments that were imported first. A good example is the epistle organ at Andahuaylillas near Cuzco, unfortunately now in an unplayable condition, as are the organs at Cuzco's cathedral. The situation is not likely to change anytime soon.

Central America and the Caribbean

The countries between Colombia and Mexico are former Spanish colonies, with the exception of Belize, the former British Honduras. Like its northern and southern neighbors, Central America has proven a politically unstable area, encouraging neocolonization and dictatorships throughout; only Costa Rica has maintained a constitutional government for any great length of time (over 130 years). There are cathedral organs in the Costa Rican cities of Grecia, Heredia, San José, Talaran, and Zarcero; the best known is at the Santuario Nacional de Nuestra Señora de los Angeles in Cartago (rest. 2000); Cartago also has the Ordo Eremitarum Sancti Augustini instrument now at the convent of San Francisco de Asis. Cavaillé-Coll built two organs for Costa Rican locations. La Merced in Guatemala City (1767) has an organ that dates from 1773. Several Central American nations have Walcker instruments: San Salvador (El Salvador), Guatemala City (two), and one each in León and Managua in Nicaragua. Another Guatemalan city, Quetzaltenango, has a TAMBURINI organ from Italy. The WURLITZER Company, one of the few U.S. firms to place instruments south of its own border, installed a "huge" organ in the Panama City Hilton Hall, as well as three instruments in Buenos Aires.

The Caribbean lacks the nearly uniform political history of the rest of Latin America, and still has a number of European (and American) colonies. During its postcolonial, U.S.-dominated years at the beginning of the twentieth century, Cuba had Spanish instruments installed in the cathedrals at Santiago de Cuba (J. Roques e Hijos, after 1911) and Cienfuegos (Rafael Puignau), as well as the Basque builder Eleizgaray's instrument at the Jesuit college in Belo, Havana. In Puerto Rico, San Juan's La Miragrosa de las Hermanas de la Caridad had a Puignau instrument; this city also imported a Tamburini, while San German had an AUSTIN ORGANS INC. instrument. The Bahamas, a former British colony, has three postwar organs made by Oberlinger (e.g., Nassau, Christ Church Cathedral, 1986); another Commonwealth member, Trinidad and Tobago, has had an organ at the Cathedral of the Immaculate Conception in Port of Spain since 1845; a WALKER and Sons instrument was installed there in 1913. Cavaillé-Coll built organs for Martinique (Saint-Pierre, Cathedral, 1882), Guadeloupe, Cuba, Puerto Rico, and Haiti, which also had a Rieger in Port-au-Prince. The Netherlands Antilles island of Curaçao has a Vermeulen in the city of the same name and D. A. FLENTROP organs in Willemstad and Suffisant. New Zealand builder David Hudd reports that, during his postwar travels, he saw instruments in Barbados, St. Vincent, Grenada, Dominica, Antigua, Montserrat, and Jamaica.

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CERVEIRA, ANTÓNIO (XAVIER) MACHADO E (1756–1828)

Portuguese organbuilder. Highly prolific, he produced over one hundred instruments, of which some thirty survive. Cerveira, born in Tamengos Anadia, Coimbra, on 1 September 1756, was trained by his father, Manuel Machado Teixeira, with whom he helped build a large monastery organ at Lisbon, Jerónimos (1781). His older stepbrother Joaquim Machado de Castro was active in the architectural reconstruction of Lisbon after the earthquakes of 1755; a political connection such as this probably aided Cerveira in obtaining commissions. However, organbuilders were faced with the economics of recovery; not only did this limit the availability of material, but seemed to produce stylistic uncertainty; only later in his career did Cerveira stay with a neoclassical aesthetic. Many of his early instruments were located in Lisbon, usually with divided stops: S. Pedro de Alcantara (1784; moved to S. Roque, 1844; case survives); Church of the Martyrs (1785–89; moved to Odivelas/Lisbon, extant); Basílica da Estrela, two Baroque-style organs (upper gallery, 1789; unplayable; chapel positive, 1791; playable); and Palmela residence chapel (1790; case survives; one of four Cerveira built for this family). Two early instruments outside Lisbon were for the royal villa in Bemposta/Algarve (1792) and Lorvão/Coimbra, S. Maria de Lorvão (1795; Rococo/classical mixture, survives in poor condition).

Cerveira's greatest triumphs were the chapel organ for Sintra, Queluz Palace, and the three organs (subcontracted to him by Joaquim A. P. FONTANES) built for the royal basilica at Mafra, Lisbon (begun 1792, completed 1807); as a result he was appointed royal organbuilder. Later work includes Borba, S. Bartolomeu, and Boliqueime/Algarve (both 1808). As Cerveira's career progressed, he increasingly built smaller instruments. He exported instruments to Portuguese colonies abroad, notably the Azores (Terceira, S. Francisco, 1788; Angra do Heroismo, Jesuit College, 1798; Ponta Delgada, S. Sebastião, 1828). Cerveira died in Caxias, Lisbon, on 14 September 1828. His habit of placing an oval plate with his name, opus number, and date of completion above the manual makes his career path unusually easy to follow during a period when information about most Iberian organbuilders is patchy at best.

RICHARD KASSEL

CHAIR ORGAN

A seventeenth-century English term (also *chaire*, *chayre*, etc.) for the Renaissance RÜCKPOSITIV, applied when the KEYBOARD and CHEST were separate from the GREAT organ and located behind the organist, requiring him or her to turn around to play it. When the chair organ was later incorporated into the main chest, it became known as the CHOIR division, possibly to indicate that its relatively lower dynamic level was appropriate for choral accompaniment. The terms were often interchanged, and in the late eighteenth century some argued that *chair* was a corruption of *choir*, not the other way around. The chair organ contributed to the development of the SWELL division during the eighteenth century, and had virtually disappeared by the following century.

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CHALUMEAU

SEE SCHALMEI/CHALUMEAU/SHAWM

CHAMBER

SEE CASE

CHAMBER MUSIC AND ACCOMPANYING

The organ became a frequent component of the Baroque "basso continuo" (thoroughbass), in which a single bass line was "realized" by (1) a solo instrument (cello, bassoon) playing the bass line and (2) a polyphonic instrument (organ, harpsichord, lute), which either doubled the upper parts (instrumental or vocal) or filled in harmonic or polyphonic lines above the bass line. Thus, a "trio sonata" actually involved four instruments, two soloists and two players realizing the continuo part. For logistical reasons, basso continuo with organ was naturally associated with church vocal music (cantatas and masses), but services with instrumental interludes or substitutions (versets) led to the development of the sonata da chiesa (church sonata), a multimovement chamber piece for one or more solo instruments (most frequently violin) and basso continuo. The typical tempo sequence was slow–fast–slow–fast.

The organ also became the basso continuo instrument of choice for the new oratorio and sacred cantata genres. The oratorio was not liturgical, but more like an unstaged opera with an almost obligatory religious plotline; therefore an oratorio could be performed wherever the platform was large enough. The seventeenth-century works of Heinrich Schütz, Giacomo Carissimi, and Marc-Antoine Charpentier culminated in the English oratorios of George Frideric Handel in the next century, *Messiah* being the most successful. Handel's success established a tradition in Britain that persisted through the nineteenth century (Franz Joseph Haydn, Felix Mendelssohn, and Edward Elgar); associated with the popular British choral festivals, the oratorio endured there long after the genre had lost its allure elsewhere. The twentieth-century oratorio no longer required associations with religious subjects or an organ. The sacred cantata was of two types, those that resembled miniature oratorios with one or two soloists (Carissimi, Georg Philipp Telemann, Theodore Dubois) and liturgical cantatas, with choral sections in alternation with soloist pieces, concluding with a chorale joined by the congregation (Dietrich Buxtehude, Johann Sebastian Bach).

In Venice, at St. Mark's, the late Renaissance saw the emergence of the concerted style of church music: divided choruses, each supported by an instrumental ensemble that invariably included an organ. Full of motivic imitation, these echoing textures became the basis for Baroque style. Although later Baroque music incorporated the texture into a larger structure and had a greater sense of flow, the concerted style survived in the trumpet sonata genre, which required only the soloist and an organist playing a written-out (*obbligato*) part. Balancing the dynamic levels of trumpet and organ was not difficult; late Baroque trumpeters achieved unprecedented virtuosity.

The dying out of the basso continuo technique, replacement of the harpsichord and organ by the fortepiano as an accompanying instrument, and decreasing support from ecclesiastical sources helped push late-eighteenth-century composers toward secular composition. Only the increasing popularity of choral music in liturgical or nonliturgical contexts kept organists and composers active; organist, choral director, and (often) composer became one person in the rehearsal and leading of choirs. Otherwise, the organ virtually disappeared as an accompanying or chamber music instrument during the Romantic era. Among those that did compose organ chamber works were Camille Saint-Saëns, César Franck, Charles-Marie Widor, Joseph Rheinberger, Franz Liszt, Félix-Alexandre Guilmant, Arthur Foote, and Sigfrid Karg-Elert. The harmonium was used as an accompanying instrument, especially in France, aided by its relative portability and lack of religious associations.

With the loosening up of generic boundaries in the twentieth century, the organ has become a full participant in the chamber music world, in combination with strings, woodwinds, brass, percussion, or electronic tape. Among the more important composers of organ chamber music are Jean Langlais, Henk Badings, Frank Martin, Leo Sowerby, William Albright, Rayner Brown, Daniel Pinkham, Alan Hovhaness, and John Zorn.

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CHAMBER ORGAN

A small organ intended for use in a domestic music room or other modest space; terms such as house organ, cabinet organ, bureau organ, and desk organ are sometimes used, although not always with precision. A positive is either a larger and more forcefully voiced instrument for use in a larger space, or (later) a division (called a Positiv in this encyclopedia) within an organ with more than one chest and manual. Chamber organs developed from the positive, and could be voiced more loudly (or not) and used in larger spaces (or not) than positives.

In general, chamber organs have a single keyboard, no pedalboard, and from three to seven mildly voiced stops, some of which may be treated as divided stops (treble and bass). They are housed in wooden Heinrich Schütz Cases, often in the shape of a desk or "desk and bookcase" (with or without doors) or another object of furniture, even a miniature church organ for use in a small church. The pipework, action, and wind supply are within the case, with the keyboard, which in some instruments can slide into the console at the front. If wind is provided by foot power, a pedal lifting the feeder or small bellows can be operated by the player; usually, a similar device projects from the side, so that wind may be pumped by an assistant. Some recent chamber organs have electric blowers, although a freer wind supply is provided by human-operated feeders.

The key action for many chamber organs is simplified by locating the individual pallet boxes underneath the keyboard (much like Renaissance pin action), rather than above. A sticker (inflexible rod) is pushed down by the front end of the key to open the valve directly below. These actions were sometimes ingenious, due to the need to save space or to reach inconveniently located sliders.

Chamber organs were especially popular during the eighteenth century. Several seventeenth-century instruments are attributed to Bernard Smith in England, and isolated examples of earlier date can be found in various parts of Europe. Large numbers of them appeared in eighteenth-century England as well as in the Netherlands, the Toggenburg area of Switzerland, and elsewhere. English instruments were frequently imported into the North American colonies; Thomas Jefferson, for instance, considered the purchase of an English or French chamber organ, and there are records of small organs on offer, as in a 1787 estate sale in Williamsburg, Virginia, that included "a beautiful keyed chamber organ."

John Snetzler, a Swiss builder who set up shop in London in the 1740s, and Samuel Green were among the best-known makers in England. An instrument signed by Snetzler and dated London, 1761 (now at the Smithsonian Institution, Washington, D.C.) exemplifies the best English work of the time. It is housed in a "desk and bookcase" mahogany case, with glazed doors and (intentionally) broken pediment. Although no names appear beside the delicately turned drawstops, its disposition can be described as: Stopped Diapason 8', Open Diapason 8' (from c''), Flute 4', Fifteenth 2', Sesquialtera II (bass to b), and Cornet II (treble from c'). A machine stop silences the 2' and Sesquialtera/Cornet stops when engaged; a swell shutter at top of the case opens and closes by pedal; a single-fold feeder bellows may be operated by pedals at the front or the side. The compass is of this organ is GG to e''', with a short octave in the bass (lacking GG♯, AA♯, BB, and C♯). This practice was not unusual in early organs or harpsichords: it saved both space and cost, and few pieces of the seventeenth and eighteenth centuries required the omitted notes.

The division of one or more stops into treble and bass sections made it possible to produce two different sounds on a single keyboard, useful in improvisation; the machine stop made possible antiphonal effects, as found in the voluntaries of William Boyce or John Stanley. The Snetzler chamber organ described above is similar to many English instruments imported into colonial America, most of which were later discarded in favor of larger, more "modern" instruments. One such instrument, the "Brattle" organ, was made in England before 1713 and given to King's Chapel in Boston; it survives in somewhat altered form (and a nineteenth-century case) in Portsmouth, New Hampshire, St. John's.

By the early nineteenth century, American organbuilders, notably in and around Boston, were making chamber organs as well as larger instruments for churches. Among builders known for chamber instruments is Ebenezer Goodrich (1782–1841, brother of William M. Goodrich), one of whose organs (ca. 1812–15) survives at the Smithsonian Institution. It retains a strong English flavor; the only significant changes from the Snetzler stoplist is a Principal 4' (replacing the Flute) and an 8' free reed (replacing the Cornet), of which only the housing remains. The bellows are now of the double-fold type; the compass (C-f''') is unbroken.

From the mid-twentieth century onward, there has been an enthusiastic revival of the manufacture of chamber organs in both Europe and the United States. On occasion, small organs for teaching or practice may have two keyboards and pedal (with a limited number of stops), perhaps qualifying as either chamber organs or simply small organs, depending largely on their scaling and voicing.

See also **Keyboard**

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CHANNEL

SEE BELLOWS; KEY CHANNEL; MECHANICAL ORGAN; SLIDER; STOP CHANNEL; TONE CHANNEL; WINDCHEST

CHEST

The architectural space contained within a particular section or compartment of the organ CASE, usually housing the pipes of a particular type or DIVISION. (This should not be confused with the WINDCHEST or pipechest, although those terms are often shortened to "chest" in context.) As a structure, a chest rests on the bottom of a section or compartment, and the pipes speak through an opening in its front. While the traditional chest is associated with the single KEYBOARD that corresponds to its division, there are "floating" divisions playable on more than one manual, and those divided between two or more chests, depending on the tonal disposition required. The traditional network of case, chest, and pipes operated on a symmetrical arrangement (later labeled the WERKPRINZIP) that evolved with the increased number of manuals, the replacement of the medieval BLOCKWERK with the HAUPTWERK, the retention and eventual incorporation of the RÜCKPOSITIV, and the addition of other divisions.

The most obvious characteristic of the chest is the arrangement of its pipes. Pipes rest evenly on the appropriate TOE BOARD within the chest, so their outward appearance depends entirely on pipe length (and, as a result, the height of the pipe MOUTH). In the traditional arrangement, the tallest pipe is placed in front (in the middle of the chest), with progressively smaller pipes placed symmetrically behind (to the left and right). Nonfunctional (dummy) DISPLAY PIPES are often used alongside the working pipes. The arrangement of a chest's pipes tends to follow one of three patterns (identified by Bridgeman-Simon):

1. Parallel movement, where pipe tops and mouths move in tandem. The pipes are either tallest or shortest in the center of the chest. The front (FACADE, visible) pipes are arranged in a row over paneling that hides and protects action and windchests (pipe rack). Shorter pipes have shorter feet, thus producing the parallel movement. This design is associated most closely with smaller instruments or chests within larger instruments, and with builders outside central Europe.
2. Contrary movement, in which tops and mouths move in opposite directions. It is more likely to find the longest rather than the shortest pipe in the central position of the chest. This design is commonly found on larger organs and those of Central European origin.
3. Pedal note, where the pipe feet are all of the same length, resulting in mouths running in a horizontal line; most common in the lower chests. Probably the oldest and most widespread of the three patterns, the pedal note arrangement's potential for predictability can be offset by a proliferation of "mouth lines" at different section levels of large instruments.

There are two common exceptions to these patterns. In sections located at or near the center of the case (potentially at different levels), the smallest pipe is nearest the center, with progressively taller pipes to the rear (out from the center), forming into a pair of symmetrical "wings." Finally, reed pipes are usually placed for make tuning easier: either behind flue pipes, where access is through a rear-opening panel (BUNGBOARD), or in front of flues when access is directly from the front. The pipes themselves contribute other factors, notably scaling, color of metal (and subsequent gilding), and the presence of display pipes.

In addition to the paneling that protects the mechanisms at the pipes' feet, "shades" cover the tops of most pipechests. The overall design of each shade panel contributes not only to the appearance of the entire case with its symmetries and flourishes but to the image projected by each compartment. The pipe arrangements previously discussed may simply echo

those of the chest; but the design of the shade paneling may create different relationships with the base: a rounded arch that places pipes in a tone pedal arrangement (with room to spare); the same, with horizontal reinforcement and the pipe tops completely visible to the audience; pipe tops rising above rails, again completely visible; horizontals with varying degrees of filigree that offset a chest using the parallel or contrary movement arrangement; circular openings that reinforce contrary movement; pointed arches that exaggerate the degree of the mouths' contrary movement; and entire instruments with little or no shading, their pipes not necessarily gradual or symmetrical in placement, and perhaps completely visible above the toe board.
See also **Toe**

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CHIFF

The initial sound of an organ PIPE as the actual pitch begins to sound; the equivalent of tonguing a woodwind instrument. As a pipe "speaks," there is a moment between the coming on of air into the pipe and the full resonance of the note. The more gradual articulation of the Renaissance and Baroque organ gave way to an increasingly sharp (quick) articulation of the note in Romantic, electro-pneumatic, and all-electric instruments; with the postwar neobaroque movement came a return to a less "automatic" pipe speech. Problems associated with chiff include defects in the initial WINDING process, such as delays or surges of articulation ("pluck"); the "white noise" level of the chiff may be increased by inadequate VOICING.
See also **Action**

RICHARD KASSEL

CHILE

Because Chile was considered a poor relation to other American countries during the period of colonization, we do not find organs there until the second half of the eighteenth century. The Organo de Calera de Tango (1754), attributed to the Jesuit brother Georges Kranzer, is believed to be the oldest extant instrument in Chile. Nothing else is known about colonial organs. Handmade "commonplace books" from the 1840s in the archive of the Santiago Cathedral make reference to an organ by Sylvester Hesse, presumably the same one installed now at Santiago, El Sagrario. It was at that time that the great era of organ import from Europe began with the purchase of a three-manual, thirty-three-stop instrument from Flight and Son, London, in 1847.

One-third of the organs now in Chile were built locally. The Italian organbuilder Orestes A. Carlini arrived in Chile in 1895 and remained there until his death in 1938. He built around forty instruments. The Dutch organbuilder Willem van Lankeren built at least one organ in southern Chile. Of the foreign organs in Chile, there is a preponderance of German organs due to Chile's sizable German population, especially in the southern area. There are a total of twenty-six German instruments, including those by E. F. WALCKER (twelve), STEINMEYER (four), Kleuker (two), Weigle (two), Hesse, and Kuhl and Blatt.

France is also an important contributor to the organ heritage in Chile. Of the eight Chilean Aristide CAVAILLÉ-COLL instruments in the Gilbert Huybens catalog for the International Society of Organbuilders (1985), only six have been located; on the other hand, two other Cavaillé-Coll organs not in the catalog are in Santiago. Other French organs in Chile include: Joseph MERKLIN (three), Bourgarel, Commaille, Debierre, Neuville, Stiehr, and Stoltz. There are eighteen French organs in Chile, if the French-style organ at La Serena, Santo Domingo is included.

England has provided nine instruments: Forster and Andrews (seven), Henry Jones and Sons, and B. Flight and Son. There are also instruments of Italian origin: VEGEZZI-BOSSI (three), Bernasconi (two), Balbiani, Inzoli, and Morettini. Belgium and Holland have placed one instrument each, by Schuyvels and Verschueren, respectively. There are two Spanish-built instruments; Santiago Poggi, an Italo-Argentine builder, made two instruments, both located in Santiago.

Single instruments by the ESTEY firm and Otto HOFMANN represent the extent of the contribution of American organbuilders. The Hofmann organ, previously at St. John's Methodist in Lubbock, Texas, was installed in 1998 at the new cathedral in Valdivia. In total, there are 125 organs in Chile, with fourteen instruments of unknown provenance.

See also **Central and South America**

LUIS GONZALEZ-CATALAN

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Chilean Pipe Organ Site. <http://www.clr.cl/English-Idx.asp>.

CHIMES

A percussion stop consisting of real bells or tubular chimes, struck by hammers that are actuated by a pneumatic or electric mechanism. In a few cases this stop has been given its own manual on an organ, with mechanical linkages between the keys and the hammers. It is usually of short compass, sometimes little more than an octave. While some sources equate this stop with the Glockenspiel, the latter uses a different sound-producing mechanism. The term "Carillon" has been used as a synonym, but is equally likely to be a type of mixture rather than a percussion stop.

See also **Stop**

EDWARD L. STAUFF

CHIMNEY FLUTE

SEE ROHRFLÖTE/CHIMNEY FLUTE/FLÛTE À CHEMINÉE

CHOIR

An organ DIVISION; the term's origin is lost in the confusion of history. Theories of its origin abound: a misreading of CHAIR ORGAN, the name of the RÜCKPOSITIV division on early English organs; a division intended to accompany the singers of the choir; a division that literally supported the chair on which the organist sat; or a detached division in early instruments that required a separate chair for the organist to sit on while playing it. No matter: the name has come to signify a somewhat recently developed division type, quite apart from the POSITIV, GREAT, or SWELL. Continental pipe organs did not have a Choir division, and the term has come to be associated with an enclosed division, playable from the bottom keyboard on nineteenth- and twentieth-century organs in England and America, marked by unobtrusive voicing and tonal design.

The Choir division lacks the power to compete with the Great or Swell, and has none of the functions of the Rückpositiv, which occupied the bottom keyboard in older instruments. It is somewhat bland in concept, and this is indeed its métier. It accompanies, solos, and provides quieter, more subjective sounds than the Great or the expressive and intense Swell. Its musical function and literature are not rooted in historic performance, and it cannot serve either as a BRUSTWERK or a Positiv; it is a development of the late Romantic era and the style of sacred music prevalent in the early years of the twentieth century.

The Choir is a secondary or tertiary division, but its potential rests on its design and voicing. In its least capable form, it collects the stops that did not fit on other divisions. At its best, it contains vital stops and minor choruses to echo the other divisions. Less intense, it can meditate; less powerful, it provides a respite from the Great; less idiosyncratic, it can provide interludes or improvisational beginnings where cool voices lead to more extravagant developments. In competent hands, the Choir can become the division for accompanying the singers. Its misuse is due primarily to lack of understanding of its origin and purpose. It is neither the GRAND CHOEUR of France nor the early English Chair or Choir. It is not a Positiv or an Oberwerk, although it is often employed to "fake" these divisions.

For many years, the Choir was the only choice for the third division of a three-manual American pipe organ. Today, even some large three- and four-manual organs lack a Choir, and the trend is toward more colorful divisions. The Choir is not dead, however; its appearance in new organs and its retention in rebuilt instruments demonstrates its continuing role in the American church. Subjectivity has not totally succumbed to academic objectivity, and the goal to rationalize the design of organs strictly on historic precedence will not be universal. Indeed, if recent backlash against the neobaroque movement continues, and neoromantic ideas persist, an updated Choir may endure for some time.

CHARLES HENDRICKSON

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CHORALBASS

A common Pedal stop, nearly always a 4' Principal, prominently voiced for playing the melody or cantus firmus in chorale preludes; hence its name. The prefix *Choral* was used for other stops intended for the same use, such as Choralflöte, Choralprincipal, and Choralbasset. It dates from seventeenth-century Germany. It is sometimes found as a Flute rather than a Principal, and is rarely found at 2′ pitch.

See also **Stop**

EDWARD L. STAUFF

CHORTON

SEE PITCH AND PITCH STANDARDS

CHORUS

A term employed in organ-building and playing circles regarding the different ensemble possibilities of an organ and the composition of its tonal character. The chorus supports the fundamental tone by enhancing the upper partials of that tone with other pipes and generating resultant tones—often for pitches not even present in the specific organ—that further strengthen the overall sound, thereby bestowing immense variety and strength unique to the timbres created by the organist.

To understand fully the principles behind chorus design and Registration, one must first briefly look at the basics of organ pipes. The different stops of the organ can be grouped into families:

Flue (working like a recorder): Flutes, Principals, Strings, Hybrids
Reed (working like a clarinet): Chorus Reeds, Solo Reeds
Free Reed (working like a Reed Organ or harmonium)
Diaphone (using a valvular reed for loud bass stops)

In addition to the fundamental tone (first partial), every organ pipe generates a varying number of upper partials or overtones. Below are the first ten partials of pipes based on the 8' and 16' harmonic series:

Note	**Pipe**	**8' Series**		**16' Series**	
1st partial	fundamental	8/1	8'	16/1	16'
2nd partial	octave	8/2	4'	16/2	8'
3rd partial	quint	8/3	2-2/3'	16/3	5-1/3'
4th partial	octave	8/4	2'	16/4	4'
5th partial	tierce	8/5	1-3/5'	16/5	3-1/5'
6th partial	quint	8/6	1-1/3'	16/6	2-2/3'
7th partial	septième	8/7	1-1/7'	16/7	2-2/7'
8th partial	octave	8/8	1'	16/8	2'
9th partial	none	8/9	8/9'	16/9	1-7/9'
10th partial	tierce	8/10	4/5'	16/10	1-3/5'

The combining of two or more members of a tonal family to sound together constitutes a chorus. A "full" chorus would have every practical harmonic upper partial of a stop type's harmonic series present, either as a separate stop or as a Mixture. In instruments that lack one or more of the less common partials (Mutation), one may encounter a "thin" chorus, especially where the size of the instrument precludes the inclusion of every partial.

The most important chorus is the Principal (Diapason, Prestant) chorus, which reputable organbuilders strive to furnish as completely as possible. Generally the first five or six partials are furnished as separate stops and the rest in the form of a mixture. It is impossible for a chorus to furnish every partial present in the fundamental tone, as the higher pipes would be impossibly small, nor is it necessarily desirable. Various theoretical Principal chorus compositions of a small to medium North German organ from Buxtehude's time are given below:

1. Prestant 8, Octave 4, Octave 2
2. Prestant 8, Octave 4, Octave 2, Mixtur III (1-1/3. – 1-2/3)
3. Prestant 8, Octave 4, Nasat 2-2/3*, Octave 2, Terz 1-3/5*, Sesquialtera II (2-2/3 – 1-3/5)*, Mixtur III (1-1/3 – 1-2/3)
4. Prestant 8, Octave 4, Nasat 2-2/3*, Octave 2, Terz 1-3/5*, Sifflöte 1-1/3, Sesquialtera II (2-2/3 – 1-3/5)*, Mixtur III (1-1/3 – 1-2/3), Scharff III (2/3 – 1/2 – 1/3)
5. Principal 16, Octave 8, Octave 4, Nasat 2-2/3*, Octave 2, Terz 1-3/5*, Sifflöte 1-1/3, Sesquialtera II (2-2/3 – 1-3/5)*, Mixtur III (1-1/3 – 1-2/3), Scharff III (2/3 – 1/2 – 1/3)

* The Nasat and Terz were often combined to form the Sesquialtera (or Rauschpfeife II).

At times certain partials have been included or excluded to create a certain character for the division in question. For instance, the rarely used Septième is included in a number of Aristide Cavaillé-Coll's organs and as part of a mixture in English Edwardian organs to impart a reedy "growl" to the chorus, thereby smoothing the transition between the flutes and reeds as they are added in the chorus buildup.

A similar situation can be found with flute stops, but with strings, reeds, and diaphones, a complete chorus is much smaller than those above. One might find a 16.8.4 chorus of reeds or strings on a fairly complete division, but it is rare to find mutations or mixtures (except in very large instruments) in the case of strings, and almost unheard of in the case of reeds. Cavaillé-Coll's organ at Paris, St. Sulpice, is unusual for having a 16.8.8.4.2 chorus of Trumpets on the Grand Choeur division, as is the Johannesburg Town Hall organ (Norman and Beard, 1914) with its 32.16.8.8.5-1/3.4 chorus of Trumpets on the Bombarde division.
See also **Anches; Fonds**

David Smit

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CHORUS REEDS

Reed stops that, either individually or in groups, form part of the organ's main choruses, as opposed to reed stops employed as SOLO voices, such as the EN CHAMADE (horizontal) Trumpet, Tuba, or Clarinet. Generally the stops employed in the composition of a reed chorus are of the inverted conical type, such as the Trumpets, but reed choruses that include cylindrical pipes are not uncommon, especially in secondary or tertiary DIVISIONS. Particularly in some old German organs, a chorus of Dulzian 16' and Krummhorn 8' is often encountered.

The function of chorus reeds has differed over time and location. The French are particularly renowned for their reed work, but this is not to suggest that other schools are inferior in theirs. The main schools of reed design are French, German, English, and Iberian.

French

The fiery Trompettes, Bombardes, and Clairons of the French organ are as unique as they are bold, and considered the crowning touch of the instrument. From the prerevolutionary era to the present day, organs were expected to have a set of bold, clear Trompettes and Clairons, with their characteristic sound obtained from unweighted tongues and straight shallots, and the softer Bassons or nasal Cromornes on every manual division and (often independently) the Pédale. Most medium to large organs have 16.8.4 Bombardes on the Pédale, 8.4 or 16.8.4 Trompettes on the Grand Orgue, 8.4 or (less commonly) 16.8.4 Bassons or Trompettes on the Récit, and 8.4 Trompettes or the nearly universal Trompette-Cromorne pairing on the Positif. The French chorus reed ensemble is known as the ANCHES.

German

The German reeds are designed as FOUNDATION STOPS for the most part, and are expected to blend into rather than dominate the chorus. In the Pedal the Posaune is indispensable in giving clarity to fugues and chorale preludes, and the upper registers are often used as solo stops for cantus firmus passages. Nonetheless, this division often boasts a complete chorus, even as large as 32.16.16.8.4.2 (Hamburg, Jakobikirche). The HAUPTWERK is often furnished with a single 8' Trompete (or 16' when the 8' is on another manual), a dark, relatively soft stop. It is generally employed as a addition to the 8' Prestant to give it more substance and definition. The other divisions rarely contain more than the odd Regal or Vox Humana.

English

Prior to the Victorian age, English reeds followed the Dutch and German traditions in rarity and character, although the tone was somewhat unique. With the advent of the "town hall" organ and the gargantuan organs lurking in the cathedrals came the genius of William HILL, Henry WILLIS, and NORMAN AND BEARD. The English organ and reeds now became more like the French reed choruses in purpose and power. One invention has continued to define these stops to the present day: Willis discovered that he could greatly refine the tone and increase the power of his reeds by putting weights on the bottom of the tongue of the bigger pipes. This practice is now almost universally employed in English-style reeds.

Iberian

The organs in Spain and Portugal are renowned for their batteries, especially nasal reeds, often horizontally placed. The Trompeta Real, almost always placed vertically inside the case, is the chief reed chorus stop, but the batteries of Claríns and Bajoncillos *de batalla* (en chamade) are the more often employed chorus reeds. These stops have a very free, brassy tone and are relatively quiet by themselves, but in chorus attain a remarkable carrying power.

DAVID SMIT

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CHRISMANN, FRANZ X(AVER) (1726–1795)

Austrian organbuilder; also called Griesmann and Krisman. Born in modern-day Slovenia, Chrismann had a workshop first in Wippach, then in northern Austria from 1764 on. He was ordained a priest in 1750, and studied with the Italian organbuilder Pietro Nacchini in Venice between 1754 and 1758. Later in his career, he worked with Peter Hoelzl, who had trained with Gottfried SILBERMANN in Dresden. In addition to the influence of Nacchini and the Venetian Principal organ, Chrismann's use of a variety and number of 8' stops suggests the orchestral Austrian organs of the latter eighteenth century, especially those of Joseph GABLER. Elements of the Dutch Blokwerk may also be seen. Chrismann built transitional instruments between late Baroque Italianate style and nineteenth-century Romantic instruments. His organs reflect the additive registrational practices coming into vogue in the later eighteenth century.

Chrismann's most important instruments can be seen in Linz Cathedral, the Steyr Stadtpfarrkirche, and the Augustinian monastery at St. Florian (3/74), the so-called Bruckner organ; Bruckner was organist at St. Florian's early in his life, later at Linz Cathedral. Chrismann's aesthetic reflects the emerging preference for the lush orchestral harmonies rather than the linear clarity of the classical organ sound.

BRIAN DOHERTY

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CINEMA ORGAN

SEE THEATER ORGAN

CIPHER

A pipe or group of pipes that sound, although the organist is not trying to make them do so; it usually occurs as a continuous drone when the instrument is being winded or is otherwise "on." The complexity of the pipe organ (often thousands of parts) means that ciphers are not uncommon. The causes range from a mechanical linkage problem in a tracker instrument that holds a valve open to a bit of dirt in an action magnet of an electro-pneumatic instrument. Clearing the cipher may sometimes be accomplished simply by repeating a note at the console to restore the valve-closing operation of the pipe or pipes. When this method fails, a technician must be summoned to identify the cause and correct it.

ALFRED F. SEFL

CIPRI

Italian family of organbuilders. An organist named Cipri was paid to repair an organ in Parma (1495). Giovanni Cipri (b. ca. 1505; d. Bologna, March or Apr 1575) came from Emilia-Romagna; by 1536, he was living in Ferrara. In 1537, he received a commission for an organ at Parma, S. Agostino. In 1539, he built a one-manual organ at Piacenza, S. Domenico, followed by instruments at Carpi, S. Maria Assunta (1540; reb. G. B. Sona, 1812) and Rovigo, San Francesco (1541). In 1544, he completed a 1539 commission at Piacenza, S. Francesco. Cipri is best known for an organ at Bologna, S. Martino (1556; rest., often used in recordings). Its disposition comprises a full Principale ripieno plus four Flautos (16'.8.5-1/3.2-2/3); there is also a tremulant. Cipri's last instrument, for Sant'Arcangelo di Romagna/Rimini (1576), was completed by Giovanni's sons, Giuliano Cipri and Paolo Cipri, who had gone into their father's workshop and continued it after his death. An instrument at Spilamberto, S. Adriano III was completed by the Cipris in 1578 (incorp. F. Traeri organ, 1721), as well as one for Monte San Giovanni/Bologna, S. Giovanni Battista. Paolo Cipri is credited with instruments at Perugia, S. Lorenzo Cathedral (1608); Gubbio, S. Pietro (1611); Sansepolcro, Madonna delle Grazie (1613); and Monterchi, S. Simeone (1616). 4. Agostino Cipri, son of Paulo Cipri, was active in Bologna and throughout Emilia-Romagna as a builder.

RICHARD KASSEL

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CLAIRON/CLARION/CLARIN

A 4' chorus reed, a "clear and more brilliant" octave Trumpet (Bédos de Celles), found in French main organs from the late Baroque on as well as other European instruments. The term is also used to indicate some 4' reed stops. The Spanish translation, Clarin, is not the same as the *Clarín*, a standard Trumpet placed vertically or horizontally (*de batalla*, en chamade) from the Baroque organ on.

RICHARD KASSEL

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CLARABELLA

The term *Clarabella* comes from the Latin *clarus* ("bright") and *bellus*, "beautiful"), and indicates an open wooden FLUTE stop invented by J. C. Bishop in the early 1800s. It was originally a Stopped Diapason with the stoppers removed, intended to replace the treble range of that stop, which Bishop found insufficient to balance the ever-increasing power of the Open Diapasons of the time. Pitched at 8' (rarely at 16' or 4'), it was at first a treble stop only, starting at middle c, and later extending down to tenor C, the bass comprising stopped pipes or borrowings from another rank. The open pipes of the Clarabella were only rarely extended down to 8' C (CC). It became a great favorite of English organbuilders, especially during the latter half of the 1800s. By the turn of the century, it had apparently fallen into disfavor. The tone of the Clarabella has been variously described as flutelike, full, round, velvety, thick, dull, or cloying. It has been compared to the Hohlflöte, though not as strong and full. It is generally considered to be a good solo voice, but not a good blender.

The Clarabella is constructed of open wooden pipes. Audsley gives it a mouth width of 3/4 to 6/7 of its depth, with a cut-up of 1/4 to 1/3, a level block, and no ears or beard. While originally and properly constructed with normal mouths beveled on the outside, some builders have given it inverted mouths beveled on the inside. Its upper octave is sometimes made of metal.

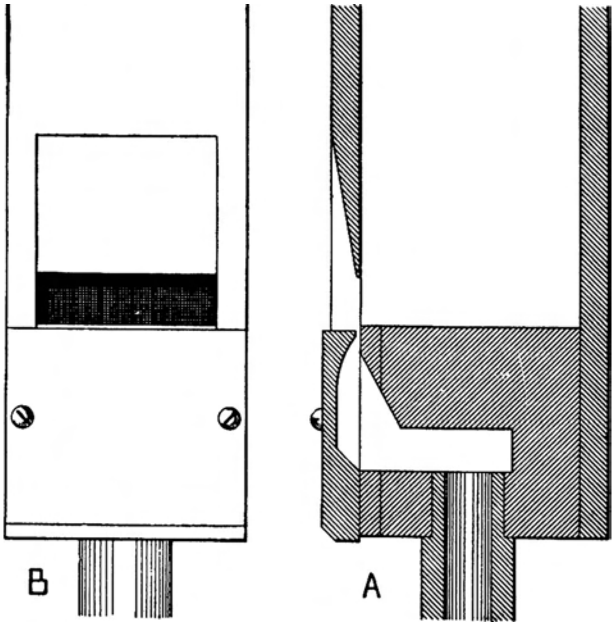

Fig. 24. Clarabella.

See also **Stop**

EDWARD L. STAUFF

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CLARINET

An imitative stop of the orchestral instrument, a generally successful and well-favored solo stop on British and American organs. It is usually found at 8' pitch, occasionally at 16', and rarely at 4', and is usually constructed with half-length (stopped) cylindrical metal resonators. This construction reinforces the odd-numbered harmonics (as with a stopped flue pipe), and gives the stop much of its characteristic hollow tone. This construction is especially common in France, England, and the United States, where it is usually made as a striking reed. In German and Swiss Romantic instruments it was usually a free reed, with a tone that some authors disparaged as feeble, thin, and not imitative.

Some Clarinet ranks have bells, which enhance the even-numbered harmonics; others have inverted-conical resonators, producing tones that are even less imitative. The resonators may be open, shaded, or capped. Wooden resonators have occasionally been used, either square or cylindrical. While generally imitative to a greater or lesser degree, the tone of the Clarinet varies a good deal. In its treble range it has been described as being even better than its orchestral prototype, but the bass is difficult to voice properly, and seldom approaches the richness of the original.

See also **Stop**

EDWARD L. STAUFF

CLARINET FLUTE

A wooden FLUTE stop of 8' pitch whose tone is reedy and reminiscent of the orchestral clarinet; most sources describe it as a variety of Rohrflöte. Audsley gives it a medium scale with longer and wider chimneys than the Rohrflöte, lower mouths (1/4 cut-up or less), thin upper lips, and fine, close nicking. Wedgwood gives it a "fairly large" scale, and reports that its tone is difficult to preserve and control. It has also been named Clarionet Flute and Cremona; the latter name has been used for other stops.

See also **Stop**

EDWARD L. STAUFF

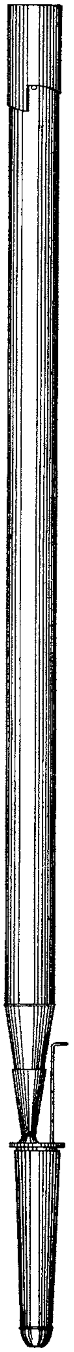

Fig. 25. Clarinet.

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CLASSICAL ORGAN (GREEK AND ROMAN ANTIQUITY)

Even after centuries of studying manuscripts and excavating archeological sites, it is still difficult to put together a chronology of the organlike instruments of the classical age. Barring the discovery of still unknown writings, objects, or representations, the history of the classical organ will remain a mosaic of a small number of writings (often second- or thirdhand) and a few precious remnants. Historians have done a more than creditable job with very little information.

The Chinese *shêng* (*khène* elsewhere in Asia), a free-reed MOUTH ORGAN of uncertain antiquity (by 1100 BCE), is sometimes considered the predecessor of the Western organ. Its resemblance rests in its graduated upright bamboo pipes, fit into a gourd with a natural mouthpiece, with which a player can produce several notes at once. But the shêng's pipes have holes that must be covered to sound, and the winding is provided solely by human breath. The Greek panpipes (*syrinx*) comprises a row of graduated tubes joined together with wax or thongs; one blows across the top to produce individual notes. Perhaps the desire for steadier WINDING was the major impetus for the classical organ; polyphonic music was apparently not part of antique (or early Western) musical style.

The story of the Western organ begins in Alexandria, the Hellenistic Egyptian empire founded in 332 BCE. According to the engineer Philo of Byzantium (fl. latter third century BCE), CTESIBIUS (Ktesibios), who may have been Philo's teacher, invented "the *syrinx* played with the hand called the HYDRAULIS [in which] the 'bellows' forced wind into a bronze pot (*pnigeus*) that rested [upside-down] in [a larger container of] water." The architect VITRUVIUS, writing in the first century BCE, was the first to describe Ctesibius's hydraulis. The *pnigeus* was fed from the outside by the bellows, piston-chamber assemblies that pushed air through a cylinder and then a tube into the *pnigeus*. To sound the hydraulis, the air was forced through a vertical tube (*solen*) to the pipechest. The pipes were grouped into a small number of ranks that could be played separately. The player caused pitches to speak by pushing a well-oiled key SLIDER inward, opening a passageway for the wind into the bottom of the pipe; the slider then returned to its initial position via an iron spring. Ctesibius's hydraulis may have been a SIGNAL ORGAN rather than a musical instrument, but by Vitruvius's time, the hydraulis was capable of producing "melodies of infinite variety." The popular and somewhat raucous instrument was found at the imperial court, theaters, and arenas, and was the subject of competitions not unlike the Greek *agon* and in today's musical world.

In a later second account of the hydraulis, by Hero (Heron) of Alexandria (fl. latter first century CE), the biggest change is the playing ACTION, in which a simple pivot device lets the player pull a key that pushes the slider in, opening the wind's passage to the pipe. As before, a spring snaps the slider back into position. This ingenious device anticipated later key mechanisms; but when the organ made its postclassical return late in the first millennium CE, the older slider mechanism was used. By the second century CE, the piston-chamber assemblies were being replaced by true BELLOWS, which collected air into a weighted bag of LEATHER, sealed off with valves, to provide wind. (The leather-bellows organ gradually superseded the hydraulis, being lighter and easier to replace, and free of corrosion.)

The coming of Christianity sealed the fate of the hydraulis in the West; early Christians felt, as did their Jewish neighbors, that instruments did not belong in the worship service, especially one so vulgar in tone and pagan in association. After the fall of Rome (fifth century), the organ survived in the Byzantine Empire, although it was limited to the royal courts. Ironically, gifts of organs from Byzantine rulers to Frankish emperors in the eighth century spurred the revival of the Western organ, and Arabic writings (themselves based on Classical sources) provided the technical knowledge necessary.

RICHARD KASSEL

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CLAVIORGAN

A keyboard instrument that plays sets of strings and pipes simultaneously. The English term is a translation of the quasi-Latin *claviorganum*, used by Michael PRAETORIUS (1619). References to keyboard instruments "with pipes underneath" are found in the 1547 catalog of Henry VIII's estate; earlier uses of the term in Spain and Italian sources may not refer to the hybrid instrument but a larger organ (as opposed to a positive or regal). Claviorgans usually had a small number of stops.

Normally, the organ chest was built with a top that held a harpsichord in place. A foot-bellows rested on the floor underneath the keyboard. The harpsichord keys activated stickers that depressed the organ pallets, much like a Renaissance organ. In smaller examples, a spinet or virginal controlled a positive or a regal, with the pipechest resting at the keyboard level (New York, Metropolitan Museum of Art, claviorgan by L. Hauslaib, 1598, Crosby Brown Collection, 89.4.1191). A well-preserved three-part claviorgan (positive-regal-spinet), attributed to S. Rorif (ca. 1564–69), is kept at the Kunsthistoriches Museum, Vienna (SAM Inv. No. A 132). Other combinations have included the clavichord-organ, the mechanical claviorgan, and conglomerations such as the organ-spinet-harpsichord-Geigenwerk (which "plays" strings with rotating wheels, like a hurdy-gurdy) from the seventeenth century.

In the eighteenth century, the emphasis shifted to pipe organs with the occasional string accessory, such as Thomas SWARBRICK's organ at Coventry, Holy Trinity (1732), with three "Dulcimer" stops that struck metal strings. Such stops were difficult to keep in tune, and their popularity was short-lived. With the advent of the fortepiano (piano), some builders (Broadwood, Taskin, Zumpe) added organ ranks to their instruments. In the 1780s, Scandinavian and Russian builders began combining pianos with early types of harmoniums. From that time into the mid-nineteenth century, a harmonium-piano was produced in small numbers (Erard-Alexandre, 1854; owned by Liszt; rest. P. Collon, 1994), but the popularity of the instrument faded soon thereafter. The claviorgan has reappeared in the catalogs of a few early keyboard builders. The copy of the Kirkman-Snetzler instrument (eighteenth century) by the OBERLINGER firm has Manual I playing the organ and harpsichord (when coupled), while Manual II plays only the harpsichord. The organ has five stops, including a Mixture; Manual I has 8' and 4' harpsichord stops.

RICHARD KASSEL

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CLEAT

In carpentry, a strip of wood or iron fastened on transversely to one or more objects to strengthen, reinforce physical connections or prevent warping. Such strips serve many purposes in organ building, ranging from securing CHESTS, keyboards (e.g., "balconizing" a two-manual CONSOLE to add a third), and other large sections to providing a felt-covered hinge for the opening of a reed organ mute.

CLIQUOT (CLICQUOT)

The most famous French organ-building family of the eighteenth century. The Cliquots were originally from the Lorraine region, but later settled in Reims. They are related to Cliquot-Ponsardin, producers of Veuve Cliquot Champagne.

Robert Cliquot (b. Reims, ca. 1645, d. Paris, 21 July 1719) was apprenticed to his half-sister's husband Étienne HÉNOCH ("organbuilder to the king") in Paris before returning to set up shop in Reims, where he married a relative of Louis XIV's private secretary in 1672. In 1679 Cliquot returned to Paris, where he and Hénoch built an organ for a chapel at Versailles. For this he also became "organbuilder to the king." Cliquot built beautiful instruments for Paris (Ste.-Geneviève, and the English Benedictine chapel), Versailles (main chapel, assisted by Julien Tribuot), the cathedrals of Soissons, Rouen, Blois, and Laon, the abbeys of St.-Jean-des-Vignes, Soissons, and Saint-Pierre, Lyon, and the collegiate church of St.-Quentin (with Alexandre THIERRY).

Two of Robert's sons became his students and collaborators: Jean-Baptiste-Simon Cliquot (b. Reims, 3 Nov 1678; d. Paris, 16 March 1746) specialized in organ pipemaking, and trained future colleagues such as Florentin Grimont. Louis-Alexandre Cliquot (b. Paris, 1683; d. there, 25 Jan 1760) continued in his father's footsteps with the title of "organbuilder to the king." He repaired more organs than he built (Chevreuese and Houdan), reconstructed the organs of Saint-Paul, Paris and the cathedral at Versailles (completed by his son François-Henry), and finished the organ of Saint-Roch in Paris, started by his cousin Francois-Henry Lescloppe (grandson of Hénoch).

François-Henry Cliquot (b. Paris, 1732; d. there, 24 May 1790), son of Louis-Alexandre Cliquot, shared a workshop until 1770 with his brother-in-law Adrien L'EPINE. From 1764 François-Henry worked with Pierre Dallery. He trained, among others, Simon Miocque (who built the organ for Angouleme Cathedral) and Christian Nyssen. François-Henry restored or renovated numerous organs in Paris, including Saint-Gervais (the organ of the Couperin family), Saint-Etienne-du-Mont, Saint-Victor, Saint-Nicolas-des-Champs, and Saint-Nicolas-du-Chardonnet, as well as Nantes Cathedral. He built a new organ for the Sainte-Chapelle (now at Saint-Germain-l'Auxerrois), the Jacobins (now called Saint-Thomas-d'Aquin), and Saint-Sulpice; outside Paris, for the abbey of Souvigny and for Poitiers, Cathedral of St. Pierre (1790; 4/44; extant; for an illustration and its specification, see FRANCE). A celebrated expert, he corresponded with the Bavarian organbuilder Karl Joseph RIEPP and left a record of his experiences in the (unfinished) *Practical Theories of Organ-Building*.

Claude-François Cliquot (b. Paris, 1762; d. there, 27 March 1801), son of François-Henry Cliquot and godson of the composer Claude Balbastre, finished the cathedral organ in Poitiers after his father's death and was involved in several organ relocations, including from Saint-Jean-en-Greve to Paris, Saint-Eustache, and Saint-Jean-des-Vignes to Soissons Cathedral (the latter under Dallery) before abandoning the profession to join the army (1794).

François-Henry Cliquot was undoubtedly the most talented of the family; in his hands French organ building attained a level of perfection, with flutes of exceptional sweetness and reed pipes of unsurpassed brilliance and excellence. Robert Cliquot's art survives only in the organ cases of Blois and the chapels of Versailles and Saint-Quentin (neither built by the Cliquots), and Louis-Alexandre's organ at Houdan is extant; however, François-Henry's organ at the cathedrals in Poitiers and Souvigny are still close enough to their original state to display the abilities of these important organbuilders.

ROLAND GALTIER
Translated by Moira Tierney

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COLLECTIONS

See Instruments, Collections

COMBINATION ACTION

See Mechanical Aids

COMMA

In tuning theory, *comma* (from ancient Greek, "thin slice") refers to (1) the syntonic comma (Ptolemaic comma, comma of Didymus), the amount (21.5 cents) that the sum of two Pythagorean whole tones (9/8 + 9/8) exceeds a pure major third (5/4; 9/8 is the difference between a pure fifth, 3/2, and a pure fourth, 4/3); or (2) the ditonic or Pythagorean comma, the amount (23.45 cents) by which 12 perfect fifths exceed seven perfect octaves (2/1), equivalent to the sum of six Pythagorean whole tones minus an octave, or six pure fifths minus six pure fourths. These two kinds of commas average about 1/9 of a whole tone. The harpsichord and clavichord are normally tuned so as to prevent any more than a smallish fraction of a comma (apart from a WOLF FIFTH in a Renaissance-style tuning).

See also **Diesis; Tuning and Temperament**

Richard Kassel

COMPASS

The range of a KEYBOARD; referred to by the standardized pitch of the keys themselves, not the actual sounding pitch of a specific stop. Thus, "compass" refers to the number and extent of keys, "range" to the pitches played by those keys. As a result, keys at similar places on two instruments or even manuals can sound different pitches.

The compass of classical and early medieval organs were determined in large part by (1) the size of the keys (initially SLIDERS) and the space between them; (2) the strength and depth necessary to depress those keys; (3) the available power of the hydraulic mechanism; (4) the instrument's CASE; and (5) application of modal theory. Once the slider was replaced by the KEY mechanism, an average of eight keys controlling up to four ranks gradually became the norm in instruments blown by BELLOWS. The wider and heavier keyboards required that the hands push the key down; in extreme cases, fists were required. With the monophonic music of the first millennium CE, instruments with larger compasses may have required additional players, although iconographic evidence is ambiguous.

In tandem with the greater complexity of Western European religious music (i.e., the introduction of polyphony around the turn of the second millennium CE), the organ grew in size to fill churches, royal chapels, or municipal halls. Additional manuals (and pedals) encouraged greater numbers of STOPS and RANKS, but compass was fixed by the size of the CONSOLE and PEDALBOARD. The use of the short octave at the bass or treble extremes (a practice that continued into the nineteenth century) further complicates the establishing of actual ranges in surviving early instruments.

The Halberstadt Cathedral organ (1361) described by Michael PRAETORIUS (1619) had two manuals (possibly requiring fists), a row of knee levers, and a pedalboard (possibly a PULL-DOWN). All four have small compasses (maximum fourteen keys), dictated by the broad keys. Compasses of European Gothic organs averaged sixteen to twenty-two keys by the end of the fourteenth century.

The trend toward wider compasses continued in the Renaissance as key widths grew narrower. POSITIVES attained compasses of thirty-five keys by the beginning of the fifteenth century; their keys were activated by fingers, similar to those of the smaller PORTATIVE organs. In the church organ, console sizes began to grow to keep up with larger (and grander) cases. There emerged a regional distinction between northern builders, who preferred multiple manuals of different compasses (from thirty to fifty keys) with restricted REGISTRATION, and southern (primarily Italian) builders, who built single-manual organs with large compasses (over fifty keys) with separate ranks of less limited registration.

As organ pitch became more systematically measured, keyboards increasingly adhered to the "C compass," allowing greater consistency between individual instruments' pitches, if not a precise value (the "universal standard" of aHz = 440Hz remains elusive to this day). In France, where much pitch theorizing was going on, a classical organ's manuals might encompass between twenty (Pédale) and forty-eight (Grand Orgue) keys. There are later Baroque English organs that range from an octave (pull-down pedal) to sixty-three unbroken notes (Great organ); Spanish and Italian instruments had manuals of similarly unbroken length. The Arnstadt and Freiberg organs associated with Bach had more conservative four-octave compasses and still used short octaves.

In the nineteenth century, technological development, particularly through the use of electricity, allowed stops and manuals to be combined instantaneously; thus the manual compass tended to remain around four octaves, especially in Germany. Aristide CAVAILLÉ-COLL and British builders preferred compasses of sixty or more keys; some late Romantic instruments were built to emulate the grand piano's compass even more closely. But the four- to five-octave compass has remained a model, whether for the early twentieth century at its most romantic (the totally unified THEATER ORGAN) or its most reactionary (the instruments of THE ORGAN REFORM MOVEMENT and postwar eras).

See also **Long Compass; Pitch and Pitch Standards**

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COMPENIUS, ESAJAS (ESAIAS) (CA. 1560–1617)

German organbuilder. Esajas Compenius was part of a prominent family of instrument makers. The dynasty was begun by Timotheus Compenius (fl. 1585–1608; organs in Bayreuth and Hof) and his brother Heinrich Compenius I (ca. 1525–1611; Fritzlar, Cathedral, 1588–90, thirty stops). Heinrich I had two sons: Esajas Compenius, and Heinrich Compenius II (ca. 1565–1631), who served as builder to the archbishop-elector of Magdeburg (Cathedral, 1604–05, forty-five stops; destr. 1945) and built instruments in Glauchau bei Halle, Leipzig, and Niederndodeleben (St. Peter and Paul, 1611; reb. M. Hartmann, 1753; extant). Heinrich II's organ-building sons included Johann Heinrich Compenius (ca. 1597–1642; Halle, St. Moritz, 1625) and Ludwig Compenius (1603–d. 1671); he built instruments in Gera, Altenburg, Weimar (palace chapel, ca. 1658; used by Bach), Kassel, and Erfurt (University Church of St. Michael, 1652; 2/15; extant).

Born in Eisleben, Esajas Compenius worked with Heinrich I on the rebuild of the instrument in Hettstedt; a disagreement on the type of chest to be used (Heinrich preferred spring-chests) led Esajas (who wanted slider-chests) to go out on his own in Magdeburg (1589); he probably worked on the St. Catherine organ there (specification in Michael PRAETORIUS's *Syntagma musicum*). He began work on a new organ for Kroppenstedt (1603), but his work was interrupted when, at the behest of Praetorius, he was engaged in 1605 as organ and instrument maker to Duke Heinrich Julius at the court of Braunschweig-Wolfenbüttel, where Praetorius had served since 1595. (He eventually completed the Kroppenstedt instrument in 1613). The two men collaborated on various projects, including a chamber organ with wooden pipes at Hesse Castle (Brunswick, 1608–10; 2/27; specification in Praetorius) for Heinrich Julius. After the duke's death (1613), the instrument was moved to the Danish royal chapel at Frederiksborg Castle, Hillerød in 1616–17 (rest. M. Kjersgaard and J. Ahrend, 1988). Esajas died there while setting up the organ. It is Compenius's only surviving instrument; maintained in its original state, it has been used in several recordings.

Compenius also helped Praetorius prepare sections of the *Syntagma Musicum*, and they shared in the writing of an unpublished treatise on organ examination (transcription and English translation in Panetta), which in turn was an important source for Andreas WERCKMEISTER's *Orgel-Probe*. Praetorius claimed that Compenius planned to publish a treatise on pipe scaling, but this work, if it ever existed, is lost. Finally, Praetorius gives the specification for Compenius's largest known organ, at Bückeburg, Stadtkirche (ca. 1615; 3/48; coupler, subsemitones, short octave; lost).

Esajas's son Adolph Compenius (ca. 1585–1650) worked alongside his father until around 1606. He went first to Magdeburg, then to Rinteln/Hannover to set his own his workshop. He built an instrument for the royal chapel in Bückeburg (1620) and served as organist and builder at the Ägidienkirche in Hannover (from 1626 on). He died in that city.

See also **Tuning and Temperament**

VINCENT J. PANETTA

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COMPENSATING MIXTURE

The *Compensationsmixtur* was invented by Friedrich Wilke of Neu-Ruppin, Germany, and first installed in the organ in Salzwedel, St. Catherine (Turley, 1838). A Pedal Mixture, it was designed to provide clarity to the lower notes, which in Wilke's time had a tendency toward dullness and slowness of speech. Each rank decreased in volume as it ascended until it was nearly inaudible. The composition of Wilke's stop was: 3-1/5", CC–GG (eight notes); 2-2/3", CC–AA (10 notes); 2", CC–GG♯ (nine notes); 1-1/3", CC–FF♯ (seven notes); and 1", CC–FF (six notes).

While the Compensating Mixture was reportedly successful in fulfilling its mission, the stop was never widely adopted. Audsley criticized it as being "insufficient and inartistic," and recommended two alternatives: "Compensating Mixture III": 4', CC–g (thirty-two notes); 2-2/3', CC–G♯ (twenty-one notes); and 2', CC–EE (seventeen notes); and "Compensating Mixture VI": 4', CC–g (thirty-two notes); 3-1/5', CC–d (twenty-seven notes); 2-2/3', CC–B (twenty-four notes); 2', CC–G (twenty notes); 1-1/3', CC–D♯ (sixteen notes); 1', CC–BB (twelve notes).

See also **Progressio Harmonica; Stop**

Edward L. Stauff

COMPONIUM

A self-composing MECHANICAL ORGAN invented in 1821 by Dietrich Nikolaus Winkel (1777–1826). Winkel, a German working in Amsterdam, had invented the metronome, but J. N. Maelzel, creator of the ORCHESTRION, patented the device before Winkel could. The componium (dimensions: 2.7 x 1.42 x 0.57 meters) may have been an attempt on Winkel's part to invent something only he could manufacture.

The componium is a machine that uses with controlled randomness to produce a series of virtually infinite variations on a single theme. It comprises two mechanical organs on one side, and a "composing machine" on the other. It has two cylinders that use pins and hooks to determine pitch and duration, respectively, of the tone. Sound is produced when the pin and hook lift a lever that opens a pipe, much like any mechanical cylinder organ.

The componium (composing) machine, however, moves the cylinders automatically in different directions and independently of each other. For example, an eighty-measure theme requires forty pin-and-hook rows (two measures per row). Seven variations are also pinned into the cylinders. The total of eight "variants" is merely the basis for shifting between rows on the cylinders as dictated by the componium machine, creating any number of possible row successions.

The upper barrel organ has five stops (Salicional, Gambe, Quintaton, Flute 4' and Flute 8'), the lower one four (Flute, Violin, Trumpet, and Flûtet). Seven componium cylinders have survived, including Michele's *La Marcher d'Alexandre*, four pieces by Louis Spohr, and the overture to *Die Zauberflöte* by Wolfgang Amadeus Mozart.

The componium was shown in London and Paris, but public interest did not answer Winkel's financial needs; he died in poverty. The componium was put away and almost disintegrated. It was eventually purchased by Victor-Charles Mahillon, the first curator of the Brussels Museum of Musical Instruments. The componium was restored in the mid-1960s; however, it is once again not in working order.

The "componiums" at the Gemeentemuseum in The Hague and at the Museum van Speeldoos tot Pierement in Utrecht are in fact mechanical clock barrel organs.

Ferdinand J. de Hen

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COMPOSERS AND THE HISTORICAL ORGAN

Successful organbuilders have always been sensitive to the requirements of the literature written for their instruments. For much of the early history of the organ, those requirements rarely extended outside one's own nation and time period. However, ever since the nineteenth century, with the advent of musicology, scholars have produced editions of hitherto unknown or forgotten organ music, continually expanding the corpus of organ repertory. This, in turn, has led to the demand by organists for instruments capable of playing the literature and, more recently, providing a reasonably authentic experience.

During the second half of the nineteenth century, the collected works of Johann Sebastian Bach and other composers of organ music appeared in print, in many cases for the first time. Bach's music was particularly influential, as it was viewed in learned circles in every Western nation as the greatest achievement in organ composition. The inability of American, British, and French organists to play the organ works of Bach on the instruments generally available to them was among the prime motivations leading to the adoption of Germanic manual and pedalboard compasses in those nations about 1850. However, the concern of the early champions of Bach's organ compositions was not so much with stylistic authenticity as with the need for an instrument on which one could play all of the notes in a given piece. Performers freely adapted the music of other nations and older periods to suit their instruments and romantic sensibilities.

In Britain and the United States, organ transcriptions of orchestral music were very popular at the end of the nineteenth century and beginning of the twentieth. Some organbuilders modified their instrument designs to facilitate performance of this new repertory. Replication of orchestral colors and textures was the goal of some builders, including Robert Hope-Jones, who followed the latter-nineteenth-century trend away from designing choruses founded on the natural overtone series, instead basing instruments on a variety of 8' registers of wide extremes in volume and color. The task of imitating the broad range of sonorities in symphonic music necessitated quick, multiple registration changes on the organ, leading to the invention of unification and easily adjustable combination actions and other console gadgetry.

In the early twentieth century, interest in previously unknown organ repertoire continued to grow among many musicians, fostered by new editions and performances of earlier music by such luminaries as Alexandre Guilmant (1837–1911) and Joseph Bonnet (1884–1944), whose publications included the *Maîtres de l'Orgue* series and the multivolume *Historical Organ Recitals,* respectively. In an era that saw the beginning of research into historical performance practice and instruments, led by pioneers such as Wanda Landowska (1877–1959) and Arnold Dolmetsch (1858–1940), organists became increasingly interested in having an "authentic" musical experience. Albert Schweitzer suggested in his pamphlet *The Art of Organ Building and Organ Playing in Germany and France* (1905–6), that the orchestral organ was not suitable for performing Bach's music, arguing for a return to techniques of organ design used by eighteenth-century builders.

This interest in older instruments led to a call for reform in German organ building (later called the *Orgelbewegung* or Organ Reform Movement) that soon spread to other European nations. Taking the work of Arp Schnitger as their primary inspiration, builders such as Rudolf von Beckerath, Theodor Frobenius, Marcussen & Son, and D. A. Flentrop began designing and constructing organs, beginning in the 1920s and '30s, with mechanical key action and pipe voicing techniques, pipe scalings, slider windchests, and case layouts inspired by eighteenth-century practice. From the 1960s to the present day, some builders, including Jürgen Ahrend and Metzler, have taken their research of historic instruments to a minute level of detail, investigating the composition and construction of pipe metal and incorporating unequal temperaments. Such firms have often rejected the console devices first offered by late Romantic organbuilders, returning to a simpler, entirely nonelectric console.

In France, the Organ Reform Movement never reached this intensity; but renewed interest in older music led to the (now often lamented) rebuilding of Romantic-style organs in a neoclassical idiom. Ironically, many instruments refashioned by twentieth-century French builders such as Fernand Gonzalez were originally French classical organs that had been romanticized by Aristide Cavaillé-Coll. The addition or alteration of mixture ranks, mutations, and chorus stops was an attempt to make organs more suitable for the performance of polyphonic literature.

In the United States, increased awareness of early music led G. Donald Harrison of the Æolian-Skinner Organ Company, Walter Holtkamp, and other firms to construct organs with Positiv divisions, Germanic stop names, and Principal choruses crowned by mixtures and mutations. The goal of these eclectic "American classic" instruments was to play all styles of organ literature in a convincing fashion, and many organbuilders around the world adopted this approach to organ design. However, despite appearing on paper as classically oriented instruments, these organs were still essentially Romantic in conception; many retained electric action and incorporated all of the console devices, couplers, and even percussion stops characteristic of the orchestral organ. However, as certain prominent European organ firms, among them Rudolf von BECKERATH and Flentrop (whose 1956 organ in the Busch-Reisinger Museum at Harvard University was particularly influential), exported their wares across the Atlantic, some American organbuilders, including ANDOVER, Charles B. FISK, Fritz NOACK, and John BROMBAUGH, adopted a more Germanic approach to organ reform in the 1960s and '70s, basing their instruments on classic, generally German, models. Other firms have joined their ranks in recent decades, such as TAYLOR AND BOODY, Paul FRITTS, and RICHARDS, FOWKES and Co.

The experience of these classically inspired organs naturally led to the desire for an authentic performance experience outside of the German Baroque repertoire. In recent decades, new organs based on non-Germanic models have been built by different builders in various styles, including French Baroque (Wolff, Montreal, McGill University, 1981; Bedient, Grand Rapids, MI, 1985, now at Denton, University of North Texas), Italian Baroque (Brombaugh, Raleigh, NC, Duke University, 1997), French Romantic (van den Heuvel, Geneva, Switzerland, Victoria Hall, 1990–02; Jaeckel, Duluth, MN, Pilgrim Congregational, 1988; Fisk, Houston, Rice University, 1997), and Spanish Baroque (Greg Harrold, Berkeley, CA, Pacific Lutheran University, Tacoma, WA, 1988).

At the beginning of the twenty-first century, music libraries are well-stocked with scores of organ music written by composers from a wide range of countries and periods. This makes modern organ design a process entailing many difficult decisions. The more severely stylized an instrument is, the more confined the body of music that instrument can effectively perform becomes. Because of short key length, meantone temperament, and limited manual and pedal compass, it is simply impossible to play French Romantic music on an Italian Baroque organ. The reverse may be feasible (e.g., playing Buxtehude on a Cavaillé-Coll–style organ), but the experience is worlds apart from performing it on a Schnitger model instrument. Some argue that the possibilities a reasonable authentic experience outweighs its drawbacks; better to be able to play one type of music with a degree of historic accuracy than to play all musical repertoires with none. Others maintain that though they cannot perform anything with strict authenticity on an eclectic instrument they can still achieve a musically satisfying result in the organ literature of many countries and periods.

Organbuilders have addressed these concerns in a variety of ways. Most builders of electric action instruments retain an "American classic" aesthetic, although their organs may emphasize one style over others. Many builders of mechanical action organs have focused primarily on historically accurate re-creations and restorations of organ construction. But others have chosen to build instruments that, though modern in conception, take their inspiration from organ design of past eras. One may encounter encased, historically influenced tracker organs that incorporate the latest technologies, including electronic stop action, electric couplers and key assists, and multiple memory levels. Such organs might combine an English or French Romantic–style Swell with eighteenth-century Germanic Principal choruses on the Great and Positiv (Beckerath, Pittsburgh, St. Paul's Cathedral, 1962; Fritts, Pacific Lutheran University, 1998). A few instruments are even equipped with two temperaments (Martin Pasi, Omaha, NE, St. Cecilia's Cathedral, 2003; Fisk, Palo Alto, CA, Stanford University, 1984).

The success of an instrument must be measured by how convincing it is in the performance of organ literature. If the future of the organ is in its past, as some have claimed, among the most important questions in organ design in the next generation will be how to treat this past, especially as the organ repertory increases in scope and bulk. The challenge for many organbuilders is to find an acceptable middle ground between the historical and the eclectic approaches. In the years to come, national styles incorporated in plans for new organs will be as good an indication of trends in recital programming (and the performers' interests) as a list of music performed at concerts during a given period.

ANDREW UNSWORTH

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COMPOSITION PEDAL

A foot-operated lever (in use by the early eighteenth century) that eliminates the need to use the hands to change stops by taking off or bringing on fixed or predetermined stops, usually by operating on the DRAWSTOP itself. It was an early form of combination action, one of the MECHANICAL AIDS that included the MACHINE STOP (shifting movement). Specifically, the single-action composition pedal could either draw out or put back (push in) sliders; double-action pedals could do both. Apparently it was often put down with too much force and consequent noise, to say nothing of wear and tear. However, the usefulness of the device, fully established in the nineteenth century, would lead to its perpetration through subsequent pneumatic, electro-pneumatic, and electric forms.

RICHARD KASSEL

COMPOUND STOP

By definition, a stop that controls more than one pitch per key; a generic term covering various MIXTURES, sounding partials of a fundamental pitch (which, however, is not sounding), breaking back over several ranks (registers) as they ascend, and emphasizing the middle and upper partials. Partials of the octave and fifth (nos. 2, 3, 4, 6, 8, et al.) are the principal components. The two terms are used almost interchangeably, but the "compound stop" category can be said to include those mixtures (ZIMBEL, CYMBAL, Fourniture, GRAND JEU, PLEIN JEU, SCHARF) that were separated off from the FOUNDATION STOPS as the BLOCKWERK was broken down; standardized mixtures incorporating additional partials, most commonly the major third (nos. 5, 10, et al.), less often the "out-of-tune" seventh (nos. 7, 14), and theoretically (if rarely) beyond (TERTIAN, RAUSCHPFEIFE, SESQUIALTERA, Cornet, the nineteenth-century COMPENSATION MIXTURE and PROGRESSIO HARMONICA); and stops simply called Mixture, their components depending on national and builder preference. Compound stops tend to have the number of ranks employed indicated by roman numeral, e.g., Mixture III, Cornet II, Sesquialtera VII–VI (varying number of ranks). Compound stops should not be confused with MUTATION stops, which use higher partials based solely on one rank, without breaking. (Such stops as the TIERCE and the Septième, usually considered mutation stops, sometimes use two ranks, making them mixtures in such cases.)

RICHARD KASSEL

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COMPTON, JOHN H(AYWOOD) (1865–1957)

English organbuilder and inventor. Born in Newton Burgoland, Leicestershire, on 20 June 1865, Compton held a six-year apprenticeship. He joined Brindley and Foster in Sheffield (1898), remaining until 1901, when he opened a partnership with Thomas Musson in Nottingham (dissolved by 1904). He established John Compton Ltd. in the same city (1912); after World War I, he acquired a workshop in Chiswick, London, and then built a factory in Willesden, London, in 1930. He was active until his death in Ealing on 6 April 1957.

Compton's work was divided between electric-action pipe organs and some of the first successful electronic organs. Possibly influenced by Robert HOPE-JONES, Compton's pipe organs were strongly based on unit organ principles; the resulting instruments were compact and therefore suitable for theatrical use. His work, noted for careful selection of extension pitches and ranks, was characterized by unusual mutations (London, St. Stephen, Coleman Street). A typical Compton organ was built for Wolverhampton, Civic Hall (1938), with two enclosed "chambers" built into the roof, instead of a case; thirty-nine sonorities were produced from fifty ranks; borrowing produced eighty-one stops, spread among five divisions (Great, Swell, Solo, Choir, Pedal). The firm's other organs include Downside Abbey (1928; 4/121); Bournemouth, Pavilion (1929; 4/161); Croydon, Davis Theatre (1929; 4/202; dism.); Southampton, Guildhall (1936; 4/121) London, BBC Broadcasting House (1932; 4/123); Hull, Holy Trinity (1937; 4/104); Great Yarmouth, Methodist Mission (1938; 3/50; now Cotton, Suffolk, Mechanical Music Museum); Lanner, Cornwall, Christ Church (ca. 1949; 2/11) and Exmouth, Holy Trinity (1953; 3/46). He rebuilt the Willis organ at Cardiff, St. Martin's, Roath, which was damaged during World War II.

The Electrone evolved out of research by Leslie Bourn, associated with Compton from the 1920s. Bourn replaced electromagnetic tone-wheels with an electrostatic system of twelve tone-wheel mechanisms, one per semitone, rotating at different speeds through a synchronous motor-and-pulley mechanism. Each semitone requires two discs, one carrying sinusoidal waveforms, the other conductive metal with electrodes. Compton's first electronic device was the Melotrone, a solo voice superimposed on electric-action theater organs; next came the Theatrone and, by 1938, the Electrone. Large-scale production of the Electrone began after World War II, gaining notoriety when one of them was temporarily installed at London's Royal Festival Hall (1951). An instrument at London, Holborn, St. Alban avoided extension altogether. Bourn continued to work for Compton until his retirement in the 1960s. Rushworth and Dreaper purchased its pipe organ department in 1964; six years later, the electronic department became the basis for Makin Organs, established by John Pilling, which now builds digital pipeless church instruments.

See also **Electronic Organ**

RICHARD KASSEL

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CONCUSSION BELLOWS (WINKER)

A wind-compensating pneumatic device, one of the REGULATORS invented in the early nineteenth century to assure as steady a flow of wind as possible, which was increasingly demanded by harmonically (vertically) oriented music. (*Winker* is apparently a reference to its blinking eye–like motion.) A small, spring-loaded cuneiform bellows is attached to the WINDTRUNK and connected to a WINDCHEST by a small tube. The concussion bellows responds to changes in air pressure within the windchest by allowing more or less air into the chamber, replacing or displacing its volume. Ideally, the concussion bellows has the effect of producing a smooth sound without "shaking" or "knocking." Once its spring-force setting has been made in relation to the hinged bellows membrane, however, the concussion bellows can only adapt to changes in pressure, not truly regulate them. At an extreme high or low end of the wind gamut, the bellows will cease to function. The SCHWIMMER performs in a similar way to the concussion bellows, but has the advantage of an adjustable pantograph for better adaptation to pressure changes.
See also **Reservoir**

RICHARD KASSEL

CONDUCTOR SYSTEM

(1) A technology that conveys air from one point to another along its path; in the case of the organ, from BELLOWS to WINDCHEST to PIPES. The tube or duct that carries air into the windchest may be considered the conductor or conveyor (WINDTRUNK), while the means of pressuring air into the conductor (e.g., BLOWERS, pallet and bellows, pneumatic motors) represent the system.

(2) On the digital ELECTRONIC ORGAN, a means of putting individual stops or combinations on or off during performance without interruption.

RICHARD KASSEL

CONE-CHEST

SEE WINDCHEST

CONSOLE

Desk or cabinet at which the organ is played, housing the KEYBOARDS, PEDALBOARD, DRAWSTOPS, combination devices, and other player-operated MECHANICAL AIDS for producing and controlling sound. This French term, which has replaced the English *keys*, *box of keys*, and *claviers*, originally applied only to a detached console (keydesk); the term now refers loosely to all keydesks, particularly in the United States. In the late nineteenth and early twentieth centuries, organ associations in the United States and Britain attempted to legislate standards of console design and size; London's Royal College of Organists arrived at such a standard in 1881. The AMERICAN GUILD OF ORGANISTS created an initial set in 1903, arriving at its final design in 1933. Despite such national regulations and individual builders' consistency of approach, consoles remain personal expressions of their builders, whether structural or decorative in nature.

The detached console is not a new phenomenon; between 1737 and 1750, Joseph GABLER built one for the organ at Weingarten, Benedictine Abbey, probably to accommodate the high Baroque architecture of the room rather than any musical purpose. However, the numerous CHOIR organs throughout France, with their detached and often reversed consoles—as well as David TANNENBERG's instruments in colonial America—testify to the historic precedent for employing this layout. Detached consoles fulfill the need of organists who direct church choirs while they are playing. When a smaller choir and organist-director are in the same area of the church, the console can be placed in front of the organ proper, the organist facing the case, and the singers grouped around the console; the console would not need to be more than six or seven feet away from the instrument. A larger choir (sixty singers or more) would likely have two "directors," with one conducting and the other accompanying. When the choir and organists are on different ends of the chancel, a detached reversed console allows the organist to play and direct; the console would again not need to be far from the instrument itself. This arrangement is also effective for a concert hall organ, in which the reversed console could be elevated so that the player could easily see the conductor and orchestra. Tracker ACTIONS can also be located under risers or other structures—even under the performer's bench. Detached consoles are also typical of instruments that use some form of electric action, but there are examples where musical or logistical issues have given way to late Romantic gigantism, such as the WURLITZER at Los Angeles, Roosevelt Memorial Park (1925), in which, according to Irwin, "the console [was] 75 feet away from the organ house and 10 feet underground [because of] the extreme volume that [was] produced by the organ."

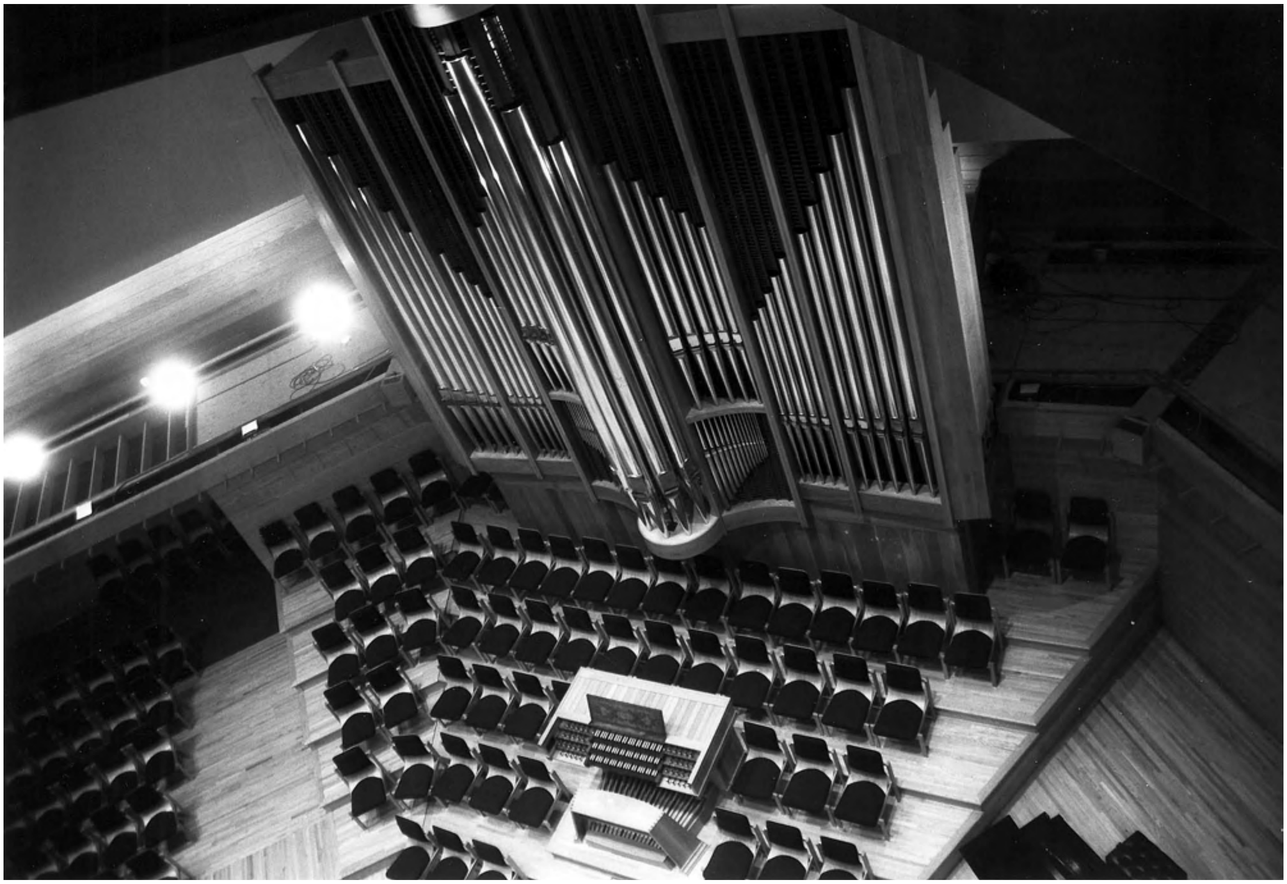

Fig. 26. Console in front of organ case with choir seating in between: Dobson organ, op. 44 (3/34), Calvin College, Grand Rapids, Michigan.

Assuming that the mechanical and tonal aspects of an organ have been constructed properly, a successful console's design must account for the limitations of the human body in order to serve the performer's physical relationship to console components properly, as well as components' to one another.

Lynn A. Dobson

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CONTIUS

German organ-building family, also known as Cuntzius and Cunzius. Christoph Contius (b. Wernigerode, ca. 1676; d. Halle, 8 Nov 1722) rebuilt the David Beck organ (1592–96) at Gröningen, Schlosskirche (1704, under Andreas Werckmeister's supervision). Contius worked in Halberstadt, producing instruments for Wernigerode (1706) and Abbenrode (1708; extant). His most significant instrument, at Halle, Liebfrauenkirche (1713–16; case front survives), was inspected by Johann Sebastian Bach, Johann Kuhnau, and C. F. Rolle, not without criticism (low wind pressure, poor pipe material), but also with praise for its special stops and ability to adjust to concert pitch. After completing this commission, Contius moved to Halle, adding a Brustwerk to the Ulrichskirche organ (1716) and building new instruments for Glaucha/Halle, St. George (1718–20) and Halberstadt, St. Paul (1721).

Christoph's son Heinrich Andreas Contius (active from ca. 1740; d. after 1782) studied with Christian Joachim. He served as inspector of organs in Halle (from 1748), later gaining the building privilege there. Known and recommended by both J. S. Bach and his son Wilhelm Friedemann, the younger Contius built classical instruments of a nonexperimental nature, avoiding Tierces in mixtures as well as mutations. Heinrich Andreas built or worked on German instruments: Giebichstein/Halle, St. Bartholomeaus (1743); Frankfurt an der Oder, Unterkirche (collab. J. S. Bach, 1748; Dieskau, St. Anna (1749–50; destr.

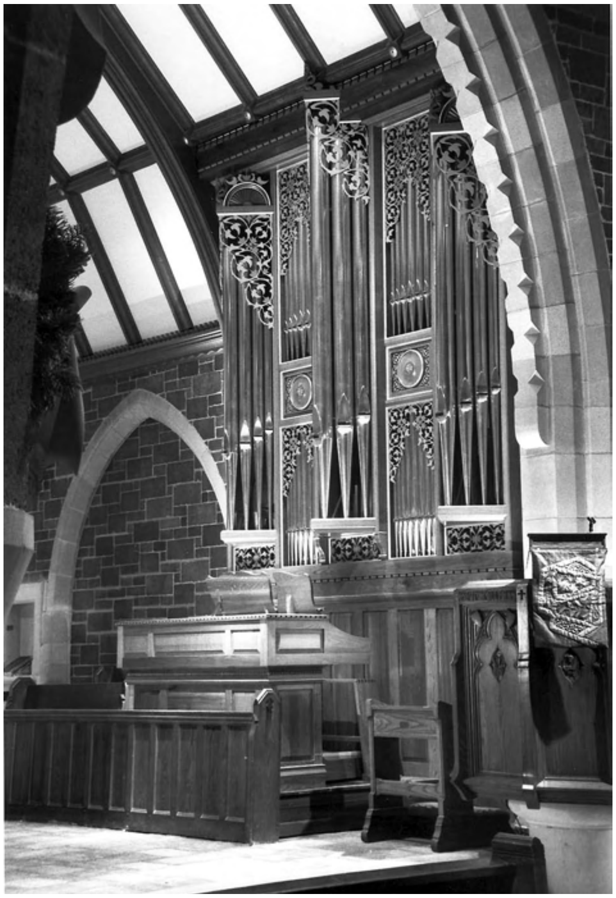

Fig. 27. Detached and reversed console with trackers running to the organ in an elevated platform under the console: Dobson organ, op. 38 (2/23), St. Stephen the Martyr, Edina, Minnesota.

1931); Merseburg Cathedral (repairs, 1759); and Halle, Moritzkirche (reb. 1766). He also rebuilt his father's instrument at Glaucha/Halle, St. George in Glaucha. Heinrich Andreas brought the central German organbuilding tradition to the Baltic, where he resided from 1763 on, eventually settling in Riga. He built organs for Riga, St. Jacobi (1766), Tallinn (1768–71), and Liepaja, Latvia, Holy Trinity (1779; extant), as well as one for St. Petersburg (ca. 1761). A builder named Adam Contius repaired the 1601 Jacob Rabe organ at Riga Cathedral (1733); his identity and relationship to Christoph and Heinrich Andreas Contius is unknown.

RICHARD KASSEL

CONTRABASS/DOUBLE BASS

A powerful imitative string stop of 16' pitch first found in nineteenth-century French Pédale ranks, especially Cavaillé-Coll's organs. Contrabass also refers to a 16' Pedal open Principal. Finally, "contra" generally indicates any stop an octave lower than its normal 8' (on occasion 16') pitch.

COPPER

Copper has been used for making organ pipes since the eleventh century, but until the tracker revival it was something of a rarity as a pipe metal. Even George A. AUDSLEY's encyclopedic *Art of Organ-Building* does not mention it except for a historic reference.

The modern use of copper for organ pipes began in the 1930s when MARCUSSEN AND SON, HOLTKAMP, and others used it to replace the zinc that had been common in larger pipes for about a century. By the late 1950s, the use of copper for pipes was widespread in new tracker organs. Entire facades of copper pipes were installed, and even entire ranks of Principals as well as many ranks of reeds and flutes were made of copper. By the late 1970s, the use of copper had declined from its earlier peak, and was mostly confined to larger bass pipes and some reed resonators. Copper pipes became a useful substitute for the large, expensive tin facade pipes and for zinc.

Copper is a long-lasting material with good strength and integrity. It requires a lot of heat to solder since it has the second highest thermal conductivity of any metal. Organbuilders do not cast or roll the copper themselves, but purchase it in a variety of thicknesses from rolling mills. A pipe metal with a wide variety of surface appearance, copper can be polished to a wonderfully warm glow and brilliance, which is then protected by a clear lacquer or other transparent coating. It may be flamed to a wide range of colors (blue, brown, gold), and it may be etched with acids and oils to form a range of colors and surface textures from glossy to flat. It can also be used "as is" from the mill. Copper does not present the visible crystal growth seen in old zinc pipes, even though it is completely crystallized.

Like zinc and aluminum, copper is preferred in alloys of rather high purity. The high purity produces a soft metal, which makes for an easier tonal transition to the very soft tin/lead alloys. Where strength is needed for large or mitered pipes, a small percentage of other metals is alloyed, as with zinc, to help the finished pipes retain their shape. The tonal characteristics of copper are hard to define, and every builder has a different opinion of its uses and sound. In reed pipes, copper seems to reinforce the upper partials, producing brilliance in some ranks, in others harshness or brittleness. It may also produce a singing sound, or a quaint buzz or rasp. Copper is a harder material than the tin/lead alloys used for the majority of organ pipes, and this can make for a somewhat "harder" sound as well.

There are many factors that influence the sound of organ pipes, and the scaling, type of metal, thickness, voicing, chest action, and layout of the organ all contribute to the final effect. Copper is another metal available to the builder, which can be used when its particular sound and appearance fit into the design of the organ. Recent changes in the prices and availability of tin, lead, copper, zinc, and aluminum seem to point to future changes in the usage ratios of these metals for organ pipes.

CHARLES HENDRICKSON

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COPULA

The etymological relationship of this term to KOPPELFLÖTE (sometimes a synonym) and to several meanings of *Coppel* (a manual coupler; another synonym for Koppelflöte; or, in the sixteenth century, a softer FLUTE stop customarily drawn with Principals or choruses) has caused some confusion. Here, the term is a more generalized interpretation of the second meaning of *Coppel*: a stop that binds the tones of other stops, unifying contrasts (tone, volume, register), mixtures, speed of speech, and types (reed and flue stops); examples date from the late medieval era. There are a variety of such stops; they may contribute to an overall timbre or compensate for a weakly designed chorus. Correct tuning is essential for the Copula to be effective, and many stops not designated as Copulas may function as such.

RICHARD KASSEL

COR ANGLAIS

SEE ENGLISH HORN/COR ANGLAIS

COR DE NUIT

SEE NACHTHORN

CORNET

SEE JEU DE TIERCE/CORNET

CORNO DI BASSETTO

SEE BASSET HORN/CORNO DI BASSETTO

CORNO DOLCE

This name has been used for a number of different stops. The earliest was apparently a wide-scaled FLUTE stop used in Italy from around 1750, sometimes of inverted conical form. Around 1810 the name was used for a soft reed stop. Different sources describe the Corno Dolce as having either cylindrical, conical, or inverted conical pipes, but invariably of soft tone, in accordance with its name. Some sources describe it as having a tone reminiscent of a horn. Audsley gives a detailed description of one form of this stop, having a large chamber below the block which is fitted with a leather diaphragm.

See also **Stop**

EDWARD L. STAUFF

CORNO FLUTE

(1) A reed stop of 8' pitch, invented by William Hill. It had wooden resonators and a quiet tone similar to that of an Oboe or Orchestral Oboe.

(2) A flue stop invented by Herbert Norman of NORMAN AND BEARD. Its tone is hornlike in the tenor range and flutelike in the treble, and was an accompanimental voice used in place of the usual Dulciana or Dolce. The pipes are metal, having inverted languids without nicks, and arched upper lips that are left unbeveled and slightly rounded, rather than being flattened. Both forms of this stop are very rare.

See also **Stop**

EDWARD L. STAUFF

CORNOPEAN

From the Latin *cornus* ("horn") and English *paean* ("hymn of praise"). A solo and ensemble chorus reed of 8' pitch, invented by William HILL for his Swell divisions, and much favored by Henry WILLIS, who perfected it. It supposedly imitated the orchestral cornet, or *cornet à pistons*, originally a post horn with valves. The date of Hill's invention is not known, but it lies between the mid-1820s, when the orchestral cornet was developed, and 1834, the date of the earliest known example. The modern Cornopean is essentially a Trumpet of larger scale, having the typical inverted conical resonators. Tonally it lies between the Trumpet and the Horn, although the name is sometimes applied to the Trumpet. Its reeds should be of the closed variety, with thick tongues, and harmonic-length resonators in the treble. In Germany the Cornopean used to be a large-scale flue stop with a hornlike tone, similar to the Cor de Nuit, but no examples are known.

See also **Stop**

EDWARD L. STAUFF

CORRIE, HENRY (1786–1858)

English-born American organbuilder. Corrie, born in London on 24 April 1786, apprenticed with George Pike and Thomas ELLIOT, two important London organbuilders. In 1822 he was sent by Elliot to erect an organ in Boston's South Church, and then decided to remain in America. From 1823 to 1827, Corrie worked for Thomas APPLETON in Boston; in 1828, he relocated to Philadelphia, where he worked in partnership with John Huber (1831–37) and later with William Wright. Corrie was particularly known for his skill as a voicer, and finished several of the organs built by Appleton. His larger instruments were installed in St. Peter's Episcopal (1830) and Holy Trinity Church (1831), both in Philadelphia, and Trinity Episcopal, Pittsburgh (1836). He died in Philadelphia on 9 August 1858. Little of Corrie's work has survived in unaltered condition. He was the most prominent organbuilder in Philadelphia between 1828 and 1845, and his organs had a wide geographical distribution.

STEPHEN L. PINEL

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COULEMENT

In Baroque keyboard articulation, an effect created by connecting notes more closely than in the usual detached manner, although not necessarily in an overly smooth (legato) fashion. An explication of the technique with examples is available in Guillaume-Gabriel Nivers's introduction to his *Livre d'orgue* I (Paris, 1665); this little-known passage is one of the most important early discussions of the subject of keyboard articulation. Hotteterre treated the term as a synonym for the appoggiatura ornament.

VINCENT J. PANETTA

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COULTER, KENNETH (B. 1937)

American organbuilder. Coulter was born in Meeker, Colorado, on 30 September 1937. While pursuing a doctoral degree in music at the University of Oregon–Eugene, he developed a strong interest in building instruments. John Hamilton, the university organist, suggested organ building as a possibility. Coulter made contact with Fritz NOACK and served an apprenticeship with the Noack firm (1970–74). He returned to Eugene and established his own shop, creating fine mechanical action organs with a classical North German tonal aesthetic. All the various parts of his instruments were constructed in his shop excepting the metal pipework. Since about 1993 he has worked as an independent contractor for Noack, building chests and other organ components.

Representative organs include: Port Angeles, Washington, St. Andrew's Episcopal (1977); Eugene, Church of Jesus Christ of Latter-day Saints (1979); Mercer Island, Washington, Holy Trinity Lutheran (1981); Federal Way, Washington, Calvary Lutheran (1982); Salt Lake City, Assembly Hall, (1985); Seattle, St. Joseph Catholic (rest. ca. 1871 Henry Willis organ, orig. UK, West Green, Christ Church; 1987; 3/31); and Provo, Utah, Brigham Young University (1987).

DOUGLAS E. BUSH

COUPLER

From the French *accouplement*. A device that makes it possible to play more than one manual or division using only one KEYBOARD. The origins of couplers for pipe organs stretch back at least four hundred years. Its antecedents are visible in Renaissance paintings that show a latch-down lever to hold the bottom note of a keyboard for a drone bass. It was not long until a PEDALBOARD appeared that was permanently coupled to the manual keys (PULL-DOWN). Eventually, separate independent Pedal ranks appeared which made it necessary, for the first time, to install a coupling action so the organist could turn the coupler on and off.

When multimanual organs appeared, it was natural to add manual-to-manual couplers. Though couplers became common, many tracker organs have been built from the sixteenth century to the present with a manual isolated from the others, with no coupler to any other manual or pedal. Tracker organbuilders occasionally pursued the use of octave couplers, and one encounters 16' or 4' couplers on some instruments, including a few built today. The use of octave couplers in tracker action was always accompanied by the problem of a heavier key action, and such couplers were usually found only in small instruments.

The eighteenth-century development of a "full" complement of couplers (16', 8', 4' couplers between each pair of manuals, and 8', 4' couplers from all manuals to pedal) accompanied a new tonal design for the organ that gradually eliminated mixtures and upper work. The 4' couplers were supposed to take the place of the newly missing upper work. Thus, couplers appeared just as they were needed to contribute to new tonal styles, and the new styles became completely dependent on the use of the full-coupler scheme—an interdependency not understood by nineteenth-century rebuilders who would discard "extra" couplers as a means of "purifying" earlier organ designs. Many coupler-dependent organs would suffer as their means of tonal fulfillment disappeared and they were left with only unison (8') couplers.

In the coupler-rich era of the early twentieth century, some bizarre examples of coupling appeared, particularly in the world of the theater organ, where non-unison couplers were utilized in some designs. We can only wonder what would be possible with couplers such as Solo to Great 8', 6-2/5', 5-1/3', 4-4/7', and 4'. Even a large church organ might have a Pedal to Pedal 4' coupler, complete with extra pipes. Such things are now rare.

As the neobaroque and neoclassical tonal designs of the late twentieth century gained favor, the reappearance of mixtures and the tonal completeness of divisions made "full" couplers less necessary. Both intramanual (Great to Great) and intermanual (Swell to Great) couplers declined in numbers, and the organ once again returned to the simple unison couplers which it once had.

Organbuilders and organists have not always understood the full implications of couplers and why older builders used them in a particular way; worse, they have simply repeated their use based on an outside source without any apparent thought. Excessive coupler use can create tonal problems; even in the best of modern tonal designs, there are severe problems of scaling and voicing if the builder must allow for 16' or 4' couplers. Where such couplers were a necessity for early tonal designs, they may now lead to trouble and overuse. It may be that organbuilders worry more about the use of couplers than any other device in the organ, and the limitation of them to the barest minimum is a way of lessening the risks involved.

However, there are factors in favor of continued inclusion of couplers. In many designs it is necessary for the builder to develop flexibility with a confining budget or space. Builders have also learned that the presence of couplers can be justified by a thoughtful design philosophy rather than the use of the "couplers, couplers everywhere" approach of the past. From a tonal standpoint, a coupler may be more essential for a certain tonal effect than any other given stop. Whether in tracker or electric organs, couplers are a part of most multimanual and pedal instruments. The thoughtful builder will include those couplers necessary for the successful use of the organ; the thoughtful organist will use those couplers with musicality and taste.

See also **Action; Mixture; Tirasse**

CHARLES HENDRICKSON

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COVELENS, JAN VAN (1470–1532)

Dutch organbuilder. Other spellings include Covelen, van Covelen, van Coblenz, and van Kobelentz. Jan van Covelens's family must have come originally from Koblenz (Rhineland), but he was probably born in the eastern Netherlands. He had his workshop in Amsterdam, and built a large number of instruments. He may have been the builder of a new organ in the St. Michaelskerk in Zwolle in 1504, but definitely worked on the organ at Utrecht, Janskerk (1507–8). In 1511, he built the still-extant one-manual organ for the St. Laurenskerk at Alkmaar (rest. Flentrop, 2000). The Alkmaar organ, the smallest and earliest known Covelens instrument, is also his best preserved work and the oldest playable organ in the Netherlands. In 1518, Covelens rebuilt the anonymous 1446 organ at Leyden, Pieterskerk (incorp. van Hagerbeer, 1643; extant). The Leyden organ and those for Rhenen, St. Cunera (1521–23) and Kampen, Bovenkerk (1524; incorp. Hinsz, 1743) had a Principal chorus (16' or 8') on the Hoofdwerk (II), a Bovenwerk (III) with Flutes, Cimbel, and Trompet, and a Rugwerk (I) with a smaller Principal chorus, several Flutes, and probably a reed (Schalmei 4').

In 1523, Covelens built a small organ for Haarlem, St. Bavo's (incorp. Haarlem, Nieuwe Kerk organ; reb. H. H. Hess, 1591; destr. 1791). The case of his instrument for Amsterdam, Nieuwe Zijdskapel (before 1523) survives in the Roman Catholic church in Jutphaas (Nieuwegein). In 1525, Covelens rebuilt the Gerrit Petersz[oon] organ (1482–84) at Utrecht, St. Mary's, adding a Bovenwerk with ten stops and a new Borstwerk with a Regaal and one or two more stops.

Covelens mades his pipes of hammered lead, as was customary in the Netherlands until around 1650; the wide scalings produce a full, rounded sounded, particularly in the Flute stops. While the Alkmaar organ still has its original slider-chests, the Haarlem organ had spring-chests. Van Covelens's outstanding pupil was undoubtedly Hendrik NIEHOFF, who completed some projects after van Covelens's death, and became the prominent Dutch builder between around 1530 and 1560.

Jan-Piet Knijff

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CRABB, HENRY (1793–1872)

English-born American organbuilder. Little is known of Crabb's education, apprenticeship, or early years in business. Born in Exeter on 18 February 1793, he first worked in Devonshire. In 1836, he went with his family to New York, and became foreman of the Firth and Hall organ shop. After a disagreement in 1838, he relocated to Flatbush (Brooklyn), New York, where he built organs under his own name until 1860. After his death in Glen Cove, New York, on 21 November 1872, he was succeeded by his sons Ebenezer, Henry L., John P. C., Stephen, and Samuel T. Crabb.

Crabb organs were said to be of fine quality and were highly regarded by their owners. His largest instruments were built for the Church of the Holy Trinity (1847), the chapel of Strong Place Baptist (1849), and St. Ann's Episcopal (1850), all in Brooklyn, New York; St. Clement's Episcopal (1852), New York; and Christ Church (1855), Bridgeport, Connecticut. A surviving Crabb organ is currently located at Watson Memorial United Methodist, Chatham, Virgina, and was recently restored by Mann and Trupiano.

Stephen L. Pinel

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CREMONA

An English corruption of *Krummhor*n (a Renaissance capped wind instrument, and an organ stop in its own right), this term has been used primarily as a synonym for *Clarinet*. In the past, some organbuilders have misinterpreted it as a violin, after Cremona, an Italian city famed for its violins. Irwin claims that the name has also been used as a synonym for Clarinet Flute. However, the name dates from around 1680, predating the introduction of the orchestral clarinet by half a century.

See also **Stop**

Edward L. Stauff

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CRESCENDO PEDAL

See Mechanical Aids

CROATIA

The earliest documentation of organ building in Croatia dates from 1359, when the organist Marko was employed at Sv. Marko in Zagreb. Dubrovnik Cathedral had a portative as early as 1384; in 1398 an organ was built for Sv. Vlaho, and by the early fifteenth century instruments were installed in major monastic churches. Two of the earliest known makers of portatives and organs in Dubrovnik are Martin Balister (fl. 1380s) and Johannes de Sibillia from Andalusia (fl. 1388–1410). In Zadar, Sv. Stošija Cathedral had an organist in 1392; in 1443 Marco degli Organi from Venice signed a contract to build an organ for the Franciscan church; the Dominican monastery got an instrument in 1510, the monastery of Dominican sisters in 1587. Split religious authorities commissioned an organ for Sv. Duje Cathedral from "frater Ventura di Fermo" in 1412; around 1500, another instrument was installed there. The famous Venetian builder Fra Urbano made an organ for Trogir Cathedral in 1484, decorated by Gentile Bellini in 1489. In 1557 Vincenzo Colombo made an organ for Korcula, decorated by a pupil of Tintoretto. By the sixteenth century most cathedrals in the southern part of the country had acquired organs (Rab, 1523; Senj, 1532; Šibenik, 1540).

Until the end of the nineteenth century, organ building in Dalmatia and Istria was strongly influenced by Italy—particularly Venice. Native builders active in Dubrovnik were Sebastian Armaliani (fl. 1554), the Dominican Benedikt Baba Babic (ca. 1540–91), Vincenc Vinko Kliševic (ca. 1743–1809), Bernardin Dubrovcanin (fl. 1813), and Gaetano Gajo Letic (1854–1916); in Split, Juraj Celidonio (fl. 1518–20);

in Zadar, Šimun Lupino (Vulpino, d. 1610); in Šibenik, Nikola Lupini (fl. 1639–43); in Rijeka, Franjo Kulic (fl. first half of the nineteeth century) and Jakov Potocnjak (1866–85); and in Cres, Ivan Cella (1840–1908).

The most significant builder in southern Croatia was Pietro Nacchini (Petar Nakic; b. Dalmatia, 1694; d. Venice, 1770), who studied with Giovanni Battista Piaggia in Venice and established his workshop there. Beginning in 1722, he completed about 350 instruments in Italy and along the eastern Adriatic coast. His surviving Croatian instruments are located in Nerežišce and Supetar on the island of Brac (both 1753), Rab (1756?), and Šibenik, Sv. Frano (1762). Domenico Moscatelli (1744–88), son of Venetian builder Nicolò Moscatelli, established his workshop in Zadar in the early 1770s. His organs are at Hvar, Franciscan monastery (1777), Nin (1780), and Hvar and Trogir Cathedrals (both 1786). Domenico's son Gaetano Moscatelli (ca. 1765–1822) worked first with his father, then moved to Pucišca (island of Brac), Korcula, Zagreb, and finally Milna. He built fifty-two instruments, including those at Poljud, Franciscan church (1786); Bol, Dominican monastery (1787); Pucišca (1793); Komiža (1795); Sutivan (1799); Korcula Cathedral (1800); Odra near Zagreb (1809); Bednja (1812); Ivanic Grad (1813)l; and Šibenik, Dominican church (1818).

Among the many foreign builders working in southern Croatia were Martinus Datis Piccardus (documented 1563), Bartol de Plamis (1663), Carlo de Beni (Vižinada, ca. 1690; Split, 1702), Moyses de Moysen (fl. 1714–28), Gaetano Amigazzi (Lovrecica, 1733), Antonio Barbini (Rovinj, 1754), Giovanni Battista Piaggia (Završje, 1740), Francesco Dacci Sr. (Donji Humac, 1775; Umag, 1776), and Francesco Dacci Jr. (Novi Grad, 1794). Gaetano CALLIDO (1727–1813), a partner and successor to Nacchini, completed twenty-nine instruments along the eastern Adriatic coast; his sons Antonio Callido (1762–1841; Cres, 1830) and Agostino Callido (d. 1826; Milna, 1820) also worked there. Nineteenth-century documents trace activities of the Bazzani family (Venice, successors to Callido; ten instruments), the Bossi family, Angelo Blozan of Trieste, Pietro De Corte of Friuli, Giovanni Battista De Lorenzi and Giuseppe Girardi of Vicenza, and Giovanni Tonoli of Brescia.

Organ building in northern Croatia was influenced by the south German style. The first known instrument in Zagreb Cathedral was installed around 1420; organists were first documented in Varaždin from 1459 and in Cazma from 1531 on. Two of the oldest extant instruments are in the Pauline monastery in Lepoglava, by an anonymous, possibly south German builder (1649), and the positive in the Muzej grada Varaždina, by Rudolf Rappolt from Bruck an der Mur (1668). The first permanent northern Croatian workshop was established in Zagreb by Antun Weiner (1706 or 1707–1747), who apprenticed with H. G. Mitterreiter in Graz. His preserved instruments are in Samobor, Franciscan church (1738), Kotari (1742), Samonor (1745), and Slani Potok (ca. 1746). Matija Taschner (Tassner) worked in Varaždin between 1782 and 1790. Other foreign builders included Christoff Lauterspekh (Zagreb Cathedral, 1669); Anton Römer (Trški Vrh, 1761; Lovrecan, 1762, Varaždinske Toplice, 1768) and Caspar Mitterreitter (Košnicki Hum, 1763), both from Graz; J. I. Zeisske from Vienna (Stari Jankovci, 1777); Mathias Vonberger (Valpovo, 1792); and Christian Clevo from Radkersburg (1779).

In nineteenth-century Zagreb, builders included Magnus Bollinger (fl. 1827–34), Josip Konrad (fl. 1806–11), Antun Werle (1775–1826), Pavao Pumpp (1801–83; active 1827–63), who completed about sixty instruments, of which eighteen remain; the Moravian builder Franjo Seibler (b. 1812, fl. 1834–46); Antun Šimenc (Schimenz, fl. 1860–ca. 1874); and Sebastijan Dobnik (1834–1913, active 1869–93).

The most prolific and significant firm in Zagreb (founded 1870, still active) was established by Mihael Mijo Heferer (1825–1887). He learned organ building in his native Graz and in Salzburg; during his lifetime the firm made 122 instruments. In 1874 the business was taken over by his stepson and apprentice Ferdo Heferer-Hubmann (1853–1928), who managed the firm, now called Heferer and Sons. He built mechanical, pneumatic, and combined mechanical-pneumatic instruments; experimented with pipe construction; and registered two patents. Heferer-Hubmann designed and built a number of stops (Euphonium, Occarina, Baryton). During his lifetime the number of instruments built by the firm reached 240. He was succeeded by his nephew August Faulend Heferer (1881–1944); during the economically hard times between 1928 and 1944 the firm built only nine instruments. The firm is today managed by Ivan Faulend-Heferer (b. 1927).

Elsewhere, Matija Jeremitz (Jeremiz, 1779–1854), Gotthard Steininger (1782 or 1792–after 1850; active 1817–50), Ignaz Petter (1805–66; active 1840–63), Josip Papa, Sr. (1810–1892), and Josip Papa, Jr. (1837–1907, active 1872–1901) worked in Varaždin. Andrija Fabing (1810–1871) established a firm in Osijek (1833), which built instruments until about 1920. In Slavonska Požega, a large number of pneumatic organs were made by Vaclav Venceslav Holub (1877–1939; active 1907–ca. 1931); in Koprivnica, Matto Schwarzmeir (Švarcmaier, 1820–1891) and Ferdo and Rihard Szabadi were active; in Karlovac, Ivan Heilinger (1797–1872); in Križevci the Erhatic family established a firm around 1890. Foreign organbuilders included the Krainz family from Graz; Franz Focht (Zagreb Cathedral, 1834; now in Pregrada) and Jozsef Angster (Valpovo, Prandau Castle, 1876) from

Pécs; Carl Hesse from Vienna (Veliki Bukovac, 1855); E. F. Walcker from Ludwigsburg, Germany (Zagreb Cathedral, 1855), and the Rieger firm of Austria (forty instruments).

Beginning at the end of the seventeenth century, several Slovenian builders built instruments in Croatia; the most significant were Ivan Feller (Zagreb, Jesuit church, 1688–89; the Cathedral, 1689–90), Andrija Sebastijan Wallenstein (Zagreb, Franciscan Monastery, 1708), Janez Jurij Eisel (Marija Gorica, 1759; Donja Kupcina, 1759; Svetice, 1761; Sv. Petar u Šumi, ca. 1770); Simon and Josip Otonic (Ottonitsch, 12 instruments), Janez Františék Janecek, and Anton Scholz; in the nineteenth century, Leonhard Ebner and Peter Rumpel; and in the twentieth century, Josip Brandl (fifty-two instruments), brothers Ignac and Ivan Zupan (fifteen instruments), and Franc Jenko (twenty-five instruments).

In a national organ survey taken between 1971 and 1975 by the state ministry of culture in Zagreb under the direction of Ladislav Šaban, 772 organs were registered in the country (553 in northern Croatia, 219 in southern Croatia), broken down chronologically: 9 instruments (seventeenth century), 93 instruments (eighteenth century), 90 instruments (1800–50), and 580 instruments (since 1850). Documentation, including a detailed technical description, specification, and photographs of each instrument, is kept at the archives of the Hrvatska akademija znanosti i umjetnosti in Zagreb.

The border with Montenegro has for the most part been a cultural extension of neighboring Dubrovnik; organs in fifteen churches along the coastal area are of the Italian type. The earliest known documentation is a contract with Francesco de Gabrielli, commissioned in 1488 to build an organ with six stops for Kotor, Sv. Tripun Cathedral in Kotor. In the eighteenth century, Nicolò Moscatelli built an organ for Kotor, Sv. Josip (1762); his son Domenico built instruments for Kotor, Sv. Marija (1771) and Muo (1784). Instruments attributed to Pietro Nacchini were in Prcanj, Sv. Marija (?1740) and Franciscan monastery (?1760). In Perast, the church of Blažena Gospa od Škrpjela has an instrument attributed to Pietro Nacchini; an anonymous instrument is located in Sv. Nikola.

Zdravko Blažekovic

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CROFT, GEORGE (1872–1955)

New Zealand organbuilder of English birth (Bermondsey, London). Croft’s family emigrated to New Zealand shortly after his second birthday, moving to Petone in the Wellington region, where his father was a builder and contractor. Largely self-taught as an organbuilder, Croft built an organ for Petone, St. Augustine’s (1899). He worked briefly in the factory of Hill and Son in London (1900–1901), then returned to New Zealand, where he set about establishing a noteworthy business in Auckland, completing over sixty instruments in his lifetime. He was the most active organbuilder in New Zealand for nearly fifty years and left a legacy of instruments that demonstrate his ability as a tonal artist, his ability in constructing reliable and prompt exhaust-pneumatic actions, and his fine woodwork and organ case design in particular.

His son William Croft continued his business with the company, renamed George Croft and Son Ltd. This was a very active concern and continued the manufacture and reconstruction of a large number of New Zealand instruments. Upon the retirement of William Croft in 1969, the company was under the governing directorship of Ken Aplin until being dissolved in 1988.

Michael A. Cox

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CROMORNE

See Krummhorn

CTESIBIUS

Ctesibus (third century BCE) was the inventor of the HYDRAULIS. Athanaeus reports in the *Deipnosophistes* that the hydraulis was invented by Ctesibius (Latinized: Ktesibios), an Alexandrian engineer. Perrot concludes from his analysis of surviving references that the inventor must already have reached manhood by 270 BCE, the period of Ptolemy II Philadelphus (ruled 285–246 BCE). Ctesibius was the first to use air pressure to operate mechanical devices; his application of pneumatic and hydraulic principles resulted in numerous inventions, which he recorded in his *Commentaries*. Although this book is cited by classical writers such as VITRUVIUS and Pliny the Elder, no copy survives. Philo of Byzantium (late third century BCE), an engineer, first attributed the invention of the hydraulis to Ctesibius. Philo was influenced by the work of his predecessor and, although he undoubtedly had access to Ctesibius's writings, did not reproduce the original design of the instrument, which he called a "*syrinx* played by the hands." More detailed descriptions of the hydraulis based on the *Commentaries* are preserved in Vitruvius's *De architectura* (first century BCE) and Hero of Alexandria's *Pneumatics* (first century CE).

See also **Classical Organ (Greek and Roman Antiquity)**

Kimberly Marshall

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CUCKOO

See Nightingale

CUNEIFORM BELLOWS

See Bellows

CUT-UP

In FLUE pipes, the relationship of the height of the pipe mouth to its width, measured as a fraction of the width of the mouth. Establishing the cut-up is the first stage in the process of VOICING pipes and a crucial determinant in both timbre and WIND PRESSURE. Even with the variety of taste and interpretation among builders, the basic effects of the cut-up have long been established. The greater the cut-up, the more emphasis there is on the fundamental of a pitch, thus the sound is louder and fuller (less bright), as in PRINCIPAL stops. The smaller the cut-up, the greater the emphasis on the partials (overtones), hence a brighter if quieter sound (STRING stops). All of these qualities are subject to the overall voicing of the pipe, its length, shape, and diameter, use of EARS and BEARDS, and differences in wind pressure being applied—all factors that require the adjusting of the cut-up to permit a pipe to speak in a stable manner.

Richard Kassel

CYMBAL/CYMBALE

From the Renaissance on, a high chorus MIXTURE, comparable in importance to the PRINCIPAL, Octave, and Fourniture, all carved out of the BLOCKWERK. The Cymbal comprises Octave and Quint ranks, sometimes adding the Tierce in earlier instruments. The classical French Cymbale contains between two and seven Octave and Quint ranks (no Tierce), breaking twice per octave.

See also **Zimbel**

Kimberly Marshall

CYMBELSTERN/ZIMBELSTERN

See Zimbelstern/Cymbelstern

CZECH REPUBLIC

Of the former Czechoslovakian regions of Bohemia and Moravia (constituents of the Czech Republic) and Slovakia (now independent), Bohemia has been most influential in the development of the Czech organ. The political dominance of the Hapsburgs and strong cultural ties with South Germany and Austria shaped Czech organ design along largely Germanic lines, the greatest creative activity in organ building occurring in the Baroque era and in the twentieth century.

After a century of war, followed by an uneasy peace, between Catholics and followers of the Protestant Jan Hus, the Catholic Hapsburgs of Austria exerted political control over much of Czechoslovakia beginning in 1526. It was during this period of religious and political turmoil that organs with a definable Czech character began to develop. The organ built in Cheb (Bohemia) in 1498 by Hans Peysinger is similar to the design described by Arnolt SCHLICK in *Spiegel der Orgelmacher und Organisten* (1511). By the end of the century a more advanced aesthetic had emerged. In 1585, Stefan Koch (d. 1590) built a two-manual and pedal organ for St. Mauricer in Olomouc (Moravia); its variety and tonal organization prefigure later Baroque instruments. The largest and most remarkable Czech organ of the period was constructed for Prague Cathedral by several builders from 1556 to 1588. It reputedly had four manuals and seventy stops, including complete Principal choruses, an independent Pedal division, and a wealth of color stops. There was also a continuing use of smaller positive and portative organs, some of which are still extant. Williams contains specifications of several significant Czech instruments, together with information on registration practices.

The best-known Czech organ of the seventeenth century is that of the Týn ("Market") Church in Prague's Old Town (1670–73) by Johannes Mundt (d. 1691), originally from Cologne. It is still extant and largely original, despite minor alterations and a major reconstruction in 1823. Although not a large instrument, there are five 8' flue stops on the HAUPTWERK. There are no reed ranks; instead, bright upper work and aggressive mixtures provide brilliance in the ensemble. This is typical of Czech organs from the seventeenth through twentieth centuries, an effect that depends on reverberant, bass-responsive acoustics to create brightness without shrillness. The same tendencies toward proliferation of 8' stops and few if any chorus reeds can be seen in other Czech organs of the period, including those in Broumov (Bohemia; 1687) and Plasy, Cistercian monastery (1690). The use of such instruments was described by Tomás Baltazar Janovka (1669–1741), organist of the Týn Church, in *Clavis ad thesaurum magnae artis musicae (*1701).

Mauritius VOGT articulated turn-of-the-eighteenth-century trends in his *Conclave thesauri magnae artis musicae* (1719). He advocated increasing the size of organs through the addition of 8' color stops; accompanimental and "echo" stops dominated the secondary divisions; the Pedal was still relatively limited. These ideas were being put into practice to varying degree by builders of larger church organs. A rather different eighteenth-century design evolved for smaller church and choir organs. A typical two-manual and pedal organ included a full Principal chorus and one or two Flute ranks on each manual, but rarely a reed or Tierce; there was often a string stop on the Hauptwerk. The few stops and small compass of the Pedal limited its use primarily to providing a harmonic bass.

The Austrian influence is seen in the number of Czech Baroque organs with divided cases. In the most usual arrangement, the large Hauptwerk and Pedal cases were placed on either side of a central window at the rear of the gallery; the RÜCKPOSITIV was centered on the gallery rail. In later organs, the console was likely to be detached and centered in the gallery. Many such divided cases still exist, including the well-preserved organ of the Deanery Church in Týn/Vlatavou. Another striking example is Prague's largest Baroque organ, at St. Nicolas (1745–46), built by the Jesuit Tomáš Schwarz (1695–1754).

The nineteenth-century aesthetic of the Romantic organ was promoted throughout Europe by Georg Joseph VOGLER, who applied his theories of "simplification" and orchestral tonal design to a major reworking of the aforementioned Baroque organ in Prague, St. Nicolas (1802). Even before these changes, this instrument had some of the low-pitched mutation ranks Vogler advocated to produce various difference tone (resultant) effects. However, most Czech builders resisted the more radical elements of orchestral organ design. Such builders as Josef Prediger of Liberec (Bohemia) and Josef GARTNER of Prague held to more conservative, classical designs well into the nineteenth century; indeed, Gartner largely reversed Vogler's changes to St. Nicolas (1834–35).

The important Austro-Czech organ-building firm of RIEGER was founded in Jägerndorf (now Krnov, Czech Rep) in 1873. During its first two decades, most organs built by this firm employed mechanical action windchests, some with Barker lever action. Later instruments featured pneumatic, then electro-pneumatic key actions. Organ schools for the education of young musicians were established in Prague (1830) and Brno (1882). The latter was founded by the Moravian organist-composer Leoš Janácek (1854–1928). In 1928, Janácek composed the *Glagolitic Mass*; the organ solo that closes this work is the single most influential Czech organ composition of the twentieth century.

The Nazi occupation of Czechoslovakia throughout World War II brought brutal repression and hardship for its people. Liberated by the Soviet army, Czechoslovakia became a socialist state in 1948. Although most religious activity was repressed by the Communist government, churches and organs were preserved as cultural monuments. Little money was made available for organ maintenance or restoration; this may have been fortunate, since restorations undertaken during the Communist era did not always reflect the highest standards of historical authenticity. In the early 1960s, the much-altered St. Nicolas organ in Prague underwent further changes, with the addition of a second, electric-action console and a fourth manual division (the so-called Fernpositiv), the latter at the opposite end of the church.

In 1948, the Rieger and Kloss organ-building firms were combined and nationalized. Rieger-Kloss was responsible for most of the organ building and restoration in Czechoslovakia during the Communist years. The firm first concentrated on electric-action organs with Romantic specifications and voicing (and Czech stop nomenclature). The ORGAN REFORM MOVEMENT came to Czechoslovakia later than to most other European countries, but Rieger-Kloss began to develop tracker instruments of more classical tonal design. These later organs reflect the traditional Czech preference for bright upper work, pungent mixtures, and few manual chorus reeds.

Since 1945, the organ has become established in Czech regions as a major concert instrument. Music festivals regularly feature well-attended organ performances. Concert halls house a three-manual organ, usually a Rieger-Kloss, often with electric key action and older German console accessories such as a rollschweller and free combinations. The organ in Prague's House of Artists, Dvorák Hall (Rieger-Kloss, 1975) is a significant attempt to fuse traditional Czech organ design with the eclectic requirements of twentieth-century recital programming. The organ (4/63) has tracker key, electric stop, and adjustable combination actions. The Principal scalings are wider than many Czech organs of the 1960s, and the traditional brilliance of Czech mixtures has been tempered to suit a relatively dry concert hall acoustic. The end of the communist era made it easier to publish books and periodicals of scholarly research and, where sufficient economic support was available, to restore historic Czech instruments.

See also **Austria**

JAMES KIBBIE

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D

DÄHNERT, ULRICH (1903–1999)

German organ restorer. Born in Dresden on 25 November 1903, Dähnert studied philosophy, German literature, history, and law in Leipzig. where he graduated with a Ph.D. dissertation on the epistemology of Albertus Magnus (1932). From 1933 to 1945 he was a research librarian at the Sächsische Landesbibliothek in Dresden; from 1952 to 1976, he freelanced as a collaborator in the restoration of numerous historic organs at the Institut für Denkmalpflege in Dresden, where he died on 18 April 1999. His papers are at the Orgelwissenschaftliche Forschungsstelle, Westfälische Wilhelms-Universität at Münster. Dähnert had a considerable influence on the preservation of Saxon organs and on organ research.

WOLFRAM HACKEL

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DALLAM

English organ-building family. Thomas Dallam I (b. Lancashire, ca. 1575; d. after 1629) traveled on behalf of Queen Elizabeth to Constantinople (1599–1600), where he installed a mechanical organ/clock, “a great and curious present . . . which will scandalise other nations,” as a gift for Ottoman Sultan Mehmet III. (For excerpts of Dallam’s diary of this experience, see Loomes.) Returning to England, he received commissions for new organs at Cambridge, King’s College, (1605–6; case survives), Windsor, St. George’s Chapel, (1609–10); Worcester Cathedral (1613–14; 2/12/no ped; supervised by Thomas Tomkins); Eton College (1613–14); Edinburgh, Holyrood Palace, (ca. 1615; two manuals, case by Inigo Jones); Oxford, St. John’s College (ca. 1617); and cathedrals in Wells (1620), Wakefield (1620), Durham (1621), and Bristol (1629, with his son Robert). Most of Dallam’s instruments were destroyed during the English Civil War; Tomkins witnessed the gradual damage inflicted by Roundhead troops on the Worcester instrument (1642–46). A better fate awaited his instrument for Oxford, Magdalen College (ca. 1615, 2/13/no ped); presented to Oliver Cromwell and installed in Hampton Court Palace; John Milton is alleged to have played it. The instrument was moved to Tewkesbury Abbey (1737; later reb.); at present, it retains pipes from the original Dallam.

Thomas’s son Robert Dallam (b. 1602; d. Oxford, 13 May 1665) was an organist and recusant Catholic who fled to Brittany in 1642, returning to England in 1660. Before his exile, he built instruments at Stanford on Avon, St. Nicholas (1630; rest. Goetz and Gwynn, 2002); York Minster (1632–34); Cambridge, Jesus and St. John’s Colleges, (1634–38); and cathedrals in Lichfield (1639) and Gloucester (1640–41). In France, Dallam built instruments for Quimper (1643–48; three organs; one extant), Plestin les Grèves (1653), St. Jean du Doigt (1654), Lesneven (1654, 1/18), and St. Pol de Léon Cathedral (1658–61, with son Thomas

Dallan II). Robert closed his career by building instruments (with sons Ralph and George) at Windsor, St. George's Chapel (1660–61); Eton College (1662–63), and Oxford, New College (ca. 1663). His ambitious French-style scheme for New College was not used, but was highly influential on English builders well into the next century.

Robert had three sons who built organs; the most prolific was Thomas Dallam II, Sieur de la Tour (b. England, ca. 1635; d. Brittany, after 1720). He remained in Brittany after 1660 and built instruments through the region, including Daoulas Abbey (1667–69; considered one of Brittany's best as late as 1790), Locronnan (1671–72), Guimiliau, St. Miliau (1675), Ergué-Gaberic (1680); Sizun (1683–84); Pleyben (1688–92), Landernau (1690–94); and Brest (1694–96); several of his cases survive. His brothers Ralph Dallam (d. London, 1673) and George Dallam (d. 1685) followed their father back to England in 1660. Either Ralph or George built organs at Norwich Cathedral (1664), Norton by Galby (1664), and Hackney, St. Augustine (1665). Ralph's instrument at London, St. Alfege, Greenwich and Christ's Hospital (begun 1672) was completed by James White. George built organs at Durham Cathedral (1662) and Dulwich College (1668–69); he stopped building after 1673.

Toussaint Dallam (b. St. Pol de Léon, 1659), son of Thomas Dallam II, assisted his father in Brittany and helped finish the Dulwich College organ after Ralph's death. His brother Marc-Antoine (Mark Anthony) Dallam, (b. Daoulas, 1673; d. York, 1730) went to England around 1710, where he probably worked for Renatus HARRIS, his cousin (as well as great-grandson of Thomas Dallam I). Marc-Antoine built new organs at Whitchurch (1730) and the chair organ at Southwell Minster (1730).

RICHARD KASSEL

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DALLERY

Family of French organbuilders of the eighteenth and nineteenth centuries, originally from Artois. The founder of the dynasty was Charles Dallery (b. Buire-le-Sec, Pas de Calais, 23 Jan 1702; d. Amiens, 10 Jan 1779). His training is unknown; his techniques were an inspiration to northern organbuilders. Settling in Amiens (1726), he was active until 1770. He built instruments for the abbeys of Corbie (1773) and Valloires (1750), and numerous organs in Amiens; finished the great 24′ organ with sixty-four reed stops at the abbey of Anchin (1738; now in Douai); and restored the organ at the abbey of Clairmarais (now at Aire-sur-la-Lys, Pas de Calais).

Pierre Dallery (b. Buire-le-Sec, 6 June 1735; d. Paris, 3 Oct 1812), nephew and student of Charles, worked with François-Henry CLIQUOT (ca. 1764–78); he subsequently worked alone until 1807. His productivity was limited: constructing a few organs and organ cases, participating in the inventory of Parisian organs undertaken by Molard (1795), and moving and reinstalling Parisian organs during the Revolution. Thomas-Charles Dallery (b. Amiens, 4 Sept 1754; d. Jouy-en-Josas, Yvelines, 1 June 1835), son of Charles, followed his father to Amiens, but left there for Paris in 1791. He became a watchmaker and later invented the propeller boat (patented 1803) and a mechanism for the pedaled harp.

Pierre-François Dallery (b. Paris, 23 July 1764), son of Pierre and student of François-Henry Cliquot, continued his father's work from 1807 until 1825. He worked as an organ restorer in Paris, and replaced almost all the full (Plein jeu) organ systems with Flute stop systems. He died in his native city on 3 October 1833. Louis-Paul Dallery (b. Paris, 23 Feb 1797; d. there, 13 Dec 1875), was the son of Pierre-François; he built the church organ at the Sorbonne (1825) and restored the organs of the cathedrals in Paris, Bourges, Versailles, and Meaux, and the abbey of Saint-Ouen in Rouen, but his refusal to renounce classical tradition, his difficult character, and the poor quality of his work ended his activity after 1859.

ROLAND GALTIER

Translated by Moira Tierney

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DAM, VAN

Dutch organ-building family. Lammert (Lambertus) van Dam I (1744–1820) apprenticed with Hendrik Hermanus Hess (from 1764 on), then worked for Albert Antoni Hinsz (from 1768 on). He set up a workshop in Groningen in 1777, relocating to Leeuwarden, Frisia (1779). Although less populous than other Dutch provinces, Friesland (western Frisia) was organ-poor enough to provide the van Dam firm with commissions (around half its total output); as elsewhere in the Netherlands, the Frisian market called primarily for smaller instruments.

Lammert I's first organ went to Oldeboorn, Dutch Reformed (1779, extant). His reputation outside Frisia was made when he rebuilt the 1769 Hinsz organ in Wassenaar/South Holland (1792–1812; reconstr. Metzler, 1974). Other instruments include: Langweer, Reformed (1784; rest. Bakker and Timmenga, 1966); Bergum, Reformed, 1788 (2/18/pull-down; rest. Flentrop, 1965); Wirdum/Groningen, Reformed (reb. 1690 van Berlikum organ, 1788–90; rest. Bakker and Timmenga, 1993); Voorburg/S. Holland, Reformed (1806; 2/24/pull-down, his largest instrument; moved to Spakenburg/Utrecht, 1881; dism. 1931); Leiden (S. Holland), Baptist (Lokhorstkerk) (reb. 1774 J. J. Mitterreither, 1805–7; rest. Flentrop, 1999); and Akkerwoude, Dutch Reformed (1818).

Lammert I's sons Luitjen Jacob van Dam I (b. Langweer, 1783; d. Leeuwarden, 1846) and Jacob van Dam I (b. Bergum, 1787; d. Leeuwarden, 1839), joined the firm in 1812 (now L. van Dam and Zonen). The typical van Dam organ, relatively small and based on the Hinsz model, was defined by restrained Empire cases, a milder tone (Bovenwerks had replaced Rugwerks by 1832), some independent Pedaal divisions, and German-style magazine bellows. Second-generation van Dam organs include: Engwierum, Reformed (1823; rest. Bakker and Timmenga, 1956); Morra, Reformed (reb. 1740 Schwarzburg organ, 1827; rest. Bakker and Timmenga, 1985–86); Ried, Reformed (reb. 1713 J. Franssen organ, 1829; rest. Steendam, 1996); Stiens, Dutch Reformed (reb. ca. 1580 A. Baders organ, 1830; extant); Tholen/Zeeland, Cathedral (1832; 3/29); and Franeker, Martinikerk (reb. 1722 Kamp/Radeker organ, 1842; rest. Bakker and Timmenga, 1997–98.

Luitjen Jacob I left the company to his sons Lammert van Dam II (1823–1904), Pieter van Dam I (1824–69), and Jacob van Dam II (1828–1907). Beginning in the 1850s, van Dam Hoofdwerk pipes were arranged chromatically; free reeds, string stops, and swell boxes were introduced. Modest Empire caseworks were superseded by Regency and neogothic designs. Among their more than 150 organs are: Drachten, Dutch Reformed "de Oase" (1845; to Harlingen, Evangelisch Lutherse Kerk, 1879; rest. Pels, 1978); Leeuwarden, Baptist (reb. 1786 Strumphler/1812 van Gruisen organ, 1848–58; Pedaal added, 1942–43; rest. Bakker and Timmenga, 1989–91); Witmarsum, Reformed (1855; rest. Bakker and Timmenga, 1964); Bolsward, Martinikerk (reb. 1781 Hinsz organ, 1861; 2/34/pull-down; rest. Verschueren, 2003); Harlingen, Reformed Cathedral (rest. 1776 Hinsz organ, 1843–52; rest. Flentrop, 1971–2001); Ternaard, Reformed (repl. 1660 A. and T. Bader organ, 1864; rest. 1992); Leeuwarden, Evangelical Lutheran, 1869 (2/14/pull-down; rest. BandT, 1969); Lytsewierrum, Reformed (1870; rest. Bakker and Timmenga, 1980); Nunspeet/Geldersland (1872; reb. Hendriksen and Reitsma, 1967–68); Anjum, Dutch Reformed (repl. 1668 Baders/1749 Hinsz organ, 1875); Ede, Oude kerk (1877; orig. Nieuw Niedorp, Reformed; moved and rest. Fels, 1967); Dokkum, Bonifatiusparochie (1882–83; rest. Bakker and Timmenga, 1993); Lopik/Utrecht, Reformed (1890; rest. Hendriksen and Reitsma, 1981); Amsterdam, Waalse kerk (reb. 1680 Langlez/1734 Christian Müller, 1891–97; rest. van Eeken, 1993); Enschede (Overijssel), Reformed Cathedral (1892; 2/39, largest van Dam tracker; rest. and enl. Flentrop, 1997; now 3/41); Wemeldinge , Dutch Reformed (1898; rest. Frentrop, 1991); Sneek, St. Martin's Cathedral (reb. 1711 Schnitger, 1898; 3/38; rest. Bakker and Timmenga to 1898 state, 1988); and Wageningen, Immanuëlkerk (1899; orig. Scheveningen, New Reformed; moved and rest. Boogaard, 1999).

At the turn of the new century, Lammert II left the firm to his sons Pieter van Dam II (1856–1927), Luitjen Jacob van Dam II (1850–1915), and Haije van Dam (1853–1927). To compete with growing firms such as Bakker and Timmenga (also in Leeuwarden), the fourth van Dam generation was forced to buy prefabricated parts and pipes. Despite the firm's turn to pneumatic action, van Dam organs began to decline in quality. In 1926, Pieter van Dam II retired, selling the firm to A. S. J. Dekker. Among the instruments produced by the last generation are: Stavoren, Reformed (reb. ca. 1780 W. Meijes organ, 1902–03; rest. Bakker and Timmenga, 1964); Makkum, St. Maartensk (rest. 1848 Naber organ, 1906; rest. Bliek, 1955); Eelde, Dorpskerk, 1907 (2/21; rest. Mense Ruiter, 1983); Midden-Beemster, 1908 (2/22; rest. van Leeuwen, 1959); Vlissingen/Zeeland, Sint Jacobskerk (1916; dism. 1968); and Twijzelerheide, Reformed (1923; reb. Hendriksen and Reitsma, 1983.

Nicolaas Albertus van Dam (b. Utrecht, 27 July, 1873; d. Blaricum [Amsterdam], 17 Jan 1967), Pieter II's son, apprenticed with Maarschalkerweerd in

Utrecht before establishing a firm in Hilversum with J. M. W. Stoker, a pianobuilder. Nicolaas Albertus remained essentially a tracker organ and harmonium builder; his first organ, for Oosterhesselen, Reformed, was a composite of Kleij and Hoogdalem divisions (1908; to Kampen, Dutch Reformed; reb. Schilder, 1983). A 1922 instrument was discovered in a Balkbrug prison in 1968; it was placed in Ruinerwold, Reformed Evangelist (1968), then moved to Beuningen, Reformed (reb. Steendam, 1997). Less successful as a pneumatic organbuilder, he remained active into the 1950s (Amsterdam, Christ Dutch Reformed, reb. 1874 P. Flaes organ, 1943; moved to Meppel, Christ Dutch Reformed, 1986; rest. Mense Ruiter, 1988).

RICHARD KASSEL

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D'ARGILLIÈRES (DARGILLIÈRES, DESARGILLIÈRES)

French family of organbuilders and organists who played a significant role in the development of the Renaissance organ in France. The early training of Antoine D'Argillières (b. before 1515; d. Paris, 1572.) is unknown, but he worked for Pierre Dugué in Paris, married Dugué's daughter, and had eight children. He worked with the organbuilder Crinon on the organ at Paris, Ste. Chapelle and succeeded him as the royal organbuilder in 1553. He built organs for the Parisian churches of St. Gervais, St. Jean-en-Grève, and St. Geneviève-des-Ardents. Three of Antoine's sons became builders; all trained with him.

The first of his sons, Gabriel D'Argillières (b. ca. 1535; d. Paris, 1585), later worked for Josse Lebel and then for Josseline in Rouen. He built the organ at Sarcelles near Paris (1559), and for the Parisian churches of Ste.-Madeleine-de-la-Cité, the Hôtel-Dieu, and St. Pierre-des-Arcis; he was contracted to repair the organ at St. Gervais in 1561. His second son, Jean D'Argillières (b. ca. 1540; d. Normandy, 1588), worked for Nicolas Dabenet. He succeeded his father in the service of the king and for a time worked with Jean de Segré. In 1576 Dabenet offered him the opportunity to take over his workshop, and he moved to Rouens. Among his organs are those at St. Michel, Rouen (1577), Le Havre (Notre-Dame), Fécamp, and Montivilliers (1587).

The third son, Roch (Roul, Paul) D'Argillières (b. Paris, 1559; d. ?Evreux, ca. 1615), was also trained by his brothers Jean and Gabriel. He joined Jean in Normandy and settled in Evreux. He succeeded his brothers and built and repaired organs in Chartres Cathedral (1598) and at the abbey church of St. Père-en-Vallée, as well as Beaumont-le-Roger, Pontoise, and Mantes (1591). His organs retained the preclassical style of French organ building. His two sons Pierre D'Argillières (ca. 1580–after 1631) and Guillaume D'Argillières (ca. 1585–after 1621) worked together in building organs, based in Treguier.

DOUGLAS E. BUSH

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DAUBLAINE-CALLINET

A succession of French organ-building firms. The first incarnation, Daublaine and Co, was founded in Paris in 1834 by the engineer Daublaine, the abbot Cabias, and the organbuilder Suret, with the intention of building small, reliable, and economical "religious organs" as opposed to the more "orchestral" organs of Aristide CAVAILLÉ-COLL.

However, the arrival in 1838 of Louis Callinet (1786–1846), member of an Alsatian family of prolific classical-style organbuilders; in 1839, Félix Danjou, composer, librarian, researcher, and future organist of Notre-Dame, Paris; and, in the same year, Charles S. BARKER, inventor of the pneumatic BARKER LEVER (in 1841), saw the expansion of what was generally referred to as Daublaine and Callinet, although it soon became Girard and Co. Their organs are notably transitional, with a reduction in the upper work, an increase in foundation stops and strings, and the introduction of swell boxes. While the firm only received a silver medal at the 1839 Paris Universal Exhibition (Cavaillé-Coll received a gold medal), they won the contract for a new 32' organ for St. Eustache, Paris, and this began a brief "golden age" for the firm, employing up to 150 workers. However, in 1843, Louis Callinet, enraged after a dispute, destroyed most of the work the firm had done in St. Sulpice; the following year, the St. Eustache organ was destroyed in a fire accidentally started by Barker.

The workshops and goods were auctioned off in 1845 to Pierre-Alexandre Ducroquet, who employed Barker, took over much of Daublaine and Callinet's work, and even rebuilt the organ of St. Eustache. The instrument he built for the London Exhibition of 1851 had some influence on English organ building. In turn, Ducroquet's firm was sold to Joseph MERKLIN (Merklin-Schütze) in 1855.

DOMINIQUE CHAILLEY
CHRISTOPHER HAINSWORTH

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DAVIDSON, WILLIAM (1831–1924)

Australian organbuilder of English birth. Born in Christchurch, Surrey, on 10 November 1831, the details of Davidson's early life, training, and emigration (?1863) are obscure. By 1866 he was employed in George FINCHAM's workshop (Richmond, Melbourne), making the metal pipes for Fincham's award-winning organ at the Melbourne Intercolonial Exhibition (1866). By 1869, Davidson was in Sydney; he built a chamber organ for the Intercolonial Exhibition there in May 1870. By 1871, he had established his firm in Karrabard, North Sydney.

Although he initially concentrated on building one-manual instruments, Davidson rebuilt and renovated historical instruments at Sydney, St. James (reb. 1827 John Gray, 1872–1903) and Sydney, St. Andrew (reb. 1866 Hill and Son, 1898; Davidson's first fully tub.-pneum. organ). Like many Australians, he erected British imports (Liverpool, St. Luke, Nicholson and Son, 1878; Mudgee, St. John the Baptist, Brindley and Foster, 1880; Summer Hill, St. Andrew, Hunter and Son, 1898). Surviving larger Davidson instruments include Bathhurst, Uniting Wesleyan (1874; mech.; reb. Davidson, 1887); Burwood, St. Paul (1881–87, mech.; reb. Davidson, 1889–91; mech./tub.-pneum., 3/26); North Sydney, St. Thomas (1886–1904; mech./tub.-pneum., 3/41; reb. Hill, Norman and Beard , 1974); and Pennant Hills, Good Samaritan Sisters (1909; orig. Greenwich, St. Giles, mech.; probably his last organ; moved 1977). A number of his one-manual organs survive, including those in Liverpool, 1873 (shipped to New Caledonia, 1901); Stanmore, 1875; Cobbitty, 1876 (orig.); Murrurundi, 1876; Morpeth, 1877 (orig.); and Parramatta, 1878 (incorp. Noad organ, 1961; 2/32, electro-pneum.).

Davidson emphasized 8' and octave-related stops (from 16' to 1') in his dispositions, emulating the sound of the English Romantic style. Mixtures and aliquots (two apiece) appear in later instruments like North Sydney, St. Thomas (his magnum opus) and Sydney, St. James. The 1890s Australian recession and a lifetime of poor business practices left Davidson, a successful builder of good reputation, virtually penniless at his death in Rockwood, New South Wales, on 4 May 1924; he was buried in an unmarked public grave.

RICHARD KASSEL

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DAVIS, WILLIAM H(ENRY) (1816–1888)

American organbuilder. Born in New York, Davis was the son of Morgan Davis, a noted local pianomaker. Although Davis advertised that his organ-building firm was founded in 1840, there is no evidence he was involved with organs until 1844, when he entered a partnership with Richard M. FERRIS. Between 1849 and 1870, Davis was independent; in 1870, he formed a partnership with his son, Albert E. Davis. Following Davis's death in New York on 1 February 1888, the firm was continued by Albert E. Davis and Henry L. Davis (?1851–1915), who worked into the early twentieth century.

W. H. Davis is believed to have built a considerable number of instruments, primarily for country churches that could not afford the major builders. One of his largest instruments was built in 1865 for St. Mark's Episcopal in Orange, New Jersey.

STEPHEN L. PINEL

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DEBAIN, ALEXANDRE FRANÇOIS (1809–1877)

French instrument manufacturer and inventor. Born in Paris, Debain originally trained as a cabinetmaker. He completed his apprenticeship in 1825 and worked in several piano factories, achieving the position of foreman. He established Debain et Cie in Paris in 1834, with a factory at St. Ouen. Several instruments of his own invention were produced here, including the Antiphonel, a piano- and organ-playing mechanism (1846); the Harmonicorde, a type of harmonium (1851); the Claviharmonium, a combined piano and harmonium (1846); and the Organophone, a suction reed organ.

Although these instruments were successful and the Antiphonel widely marketed, Debain is best known as the inventor of the harmonium, or REED ORGAN. He first patented the instrument in 1840 with one set of reeds and one blowing pedal; by claiming the name, he forced competing manufacturers to find other names for their *orgues expressif*—compression reed organs with expression. In 1842, Debain patented a larger harmonium, with four sets of reeds with bass and treble division and suboctave couplers. Debain actively pursued his competitive advantage, producing numerous harmoniums in a variety of models. In 1862 he exhibited Harmonichordes at the International Exhibition in London.

Other manufacturers, especially ALEXANDRE and Mustel, refined Debain's harmonium, and eventually eclipsed the inventor's work. After Debain's death in Paris on 3 December 1877, the business was absorbed by Maison Rodophe Fils and Debain, with a factory at Nogent-sur-Seine. This in turn was taken over by Christophe et Étienne; by 1909 the business was run by Noel Chaperon. The business flourished into the 1930s.

JAMES HOWARD RICHARDS

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DE HÉMAN (DE HÉMEN, D'HÉMEN, LE HÉMAN)

French organ-building family. Valéran De Héman (b. Hesdin, North Calais, 1584; d. Paris, Rouen, or Bordeaux, 1640). De Héman was probably apprenticed to Crespin CARLIER while the latter was working on an organ in Hesdin in 1599, according to the records. He followed Carlier to Rouen in 1600, and in 1605 married Carlier's daughter. Carlier moved to Poitiers in 1607, and De Héman took over the Rouen workshop. In 1609, at the request of Jean Titelouze, the Cathedral Chapter of Notre-Dame summoned him to Paris, where he would settle in 1616 and enjoy a brilliant career until his death. Though his work consisted largely of the expansion and modernizing of existing instruments, he soon distinguished himself as one of the leading builders in France and did much to further Titelouze's concept of the organ, playing an important role in the development of the classical French organ. De Héman installed the first short-compass manual for a solo Cornet chest in St. Séverin, Paris (1610; added Positif, 1626), and built a type of Echo for Notre-Dame Cathedral, Paris (1618).

De Héman built several important organs in Rouen: St. Jean (1607), St. Vivien (1608–1610), St. Maclou (1610), and the Cathedral (1614–15); in Paris: Ste. Chapelle (ca. 1616–17), Cordeliers (ca. 1617–18, later praised by Louis Marchand), St. Martin-des-Champs (1616–17), St. Honoré (1619), St. Jacques-de-la-Boucherie (ca. 1620), St. Jean-en-Grève (1620, 1626, 1635–39), St. Thomas-du-Louvre (1621–24), and the Carmelite Church, Place Maubert (1639); Troyes, Cathedral (1615, collab. Delhaye); Meaux, Cathedral (1627, case and 20 pipes extant); and Bordeaux, Cathédrale St-André (1627–35, two organs). He trained many important organbuilders; in addition to his three nephews, these included François Delahaie, Claude Lemoine, and Oudart Salomon (Troyes); François Ducastel (Meaux); Pierre Desenclos (Bordeaux); Pierre Cochois, Pierre PESCHEUR, and Pierre THIERRY (Paris), and De Villers (Normandy).

Louis De Héman (b. Hesdin, 1601; d. Troyes, ca. 1644), Jean De Héman (b. Hesdin, 1603; d. Cherbourg, 1660), and François De Héman (b. Hesdin, 1608; d. Paris, ca. 1652) were the sons of Valéran De Héman's brother Jean, a merchant in Hesdin, and his wife, the widow of the organbuilder LEFÈVRE. They apprenticed with their uncle between 1615 and 1628. After 1629 Louis and Jean worked with Jean and Claude de Villers in Châlons and Jean de Villers in Reims (1631). After Valéran's death, the three brothers remained in Paris, where Louis worked in Pescheur's shop (which he ran after Pescheur's death). After Louis's death, his two brothers worked with Pierre Desenclos; they were appointed as organbuilders to the king in 1648. After the death of François, Jean worked with Pierre Cochois for a time (ca. 1653), then left to work primarily in Normandy. He died in Cherbourg while building an organ in the Church of the Holy Trinity.

The second De Héman generation inherited the legacies of their uncle and Pescheur, and were active in the period between the two great organists Titelouze (1562/63–1633) and Nicholas Lebègue (ca. 1631–1702). Though not particularly innovative, they were well-respected for the quality of their work. Among their instruments were: Châlons-sur-Marne, St. Germain (1629); Vire, Notre-Dame (1631); Ivry-sur-Seine (1641); Mitry (1641-46; compl. Desenclos and Lefèvre); Rueil (1642; compl. Lesselier); Troyes, St. Jean-du-Marché (1642–45; compl. V. De Héman organ); Paris, Petits Augustins (1643); Troyes, Cathedral (1644–48, 1654); Paris, St. Médard (1646, compl. Desenclos and Lefèvre); Paris, St. Merry (1647–51; case and some pipework extant); Chartres, Cathedral (1649); Soissons, St. Jean-des-Vignes (1651–52); Rouen, Carmelite Church (1651, case now in St. Romain); Paris, St. Victor (1654); Paris, St. Etienne-du-Mont (1656); and Cherbourg, Église de Ste. Trinité (1660).

DOUGLAS E. BUSH

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DELHAYE (DELAHAYE, DE LA HAYE)

Flemish organ-building family. The history of the family's early years activity is difficult to trace, made more difficult by the variety of spellings and the relatively common surname. Andre Delahaye rebuilt an organ for Tours, St. Gatien Cathedral (1585) damaged in the French religious wars. It has since been modified (G. Lefèbvre, 1593), reconstructed (V. Lefebvre, 1920), rebuilt (Cliquot, 1733), "symphonized" (Gloton, 1927), and restored as a seventeenth-century classical instrument (D. Kern, 1996). François de la Haye was hired to rebuild a chapter organ at Troyes Cathedral in 1616. The family lineage picks up again with Louis Delhaye I, active in Ghent from about1698 and in Antwerp by ca. 1724; he also worked in the Antwerp suburb of Hoogstraten (1736). Louis Delhaye II, son of Louis Delhaye I, is credited with instruments at Bergen op Zoom, St. Gertrude Cathedral (ca. 1750; 2/24; destr. by fire, 1972); Melsele, Our Beloved Lady (ca. 1750); Oudenaarde, St. Walburga (contract, 1757); and Oosterhout (NL), Norbertine convent, St. Catharinadal (1767). He, too, was active in Hoogstraten. Dieudonné-Joseph Delhaye, son of Louis Delhaye II, continued his father's work on a smaller scale.

Jean-Joseph Delhaye (b. Antwerp, 1786; d. there, 1845), great-grandson of Louis Delhaye I, was by far the most important builder of the family. His first significant instrument, Antwerp, St. Carolus Borromeus (1808–10), was built into the eighteenth-century Johannes Baptista Forceville case. A great number of Delhaye's instruments have been lost or restored beyond recognition, but there are exceptions: Diest, Our Beloved Lady (1828); Hoogstraten, Begijnhofkerk (1832–33; 1/12/pull-down; rest. G. Loncke, 1993–2001); Steendorp (1834), Paal (1835–36; 1/11/pull-down; rest. G. Schumacher 1987–89); Zandbergen, Our Beloved Lady (1839–40; rest. 1997–2000); and Antwerp, St. Paul, reb. 1658 Hans Goltfus organ (1845; rest. 1992–96). His son Jean-Corneille Charles Delhaye (b. 1809) continued his father's work.

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DENIS, JEAN (II) (CA. 1600–1672)

Parisian harpsichord builder and organist at Saint-Barthelemy (1628–72). Denis's *Traité de l'accord de l'espinette* (Treatise on Harpsichord Tuning), initially published in 1643 and issued in a revised and expanded version in 1650, is the first French treatise devoted exclusively to PERFORMANCE PRACTICE for keyboard instruments. Beyond confirming that 1/4-comma MEANTONE TEMPERAMENT was the standard of his day for both organs and stringed keyboard instruments, Denis also addresses other subjects of interest to organists. Ornamentation, hand position, and improvisation using imitative themes are all considered, and the author also discusses certain problems related to the role of the organ in ALTERNATIM practice. As choirs often employed transpositions to place their reciting tones within a compact and convenient range, the organist had to be prepared for the often difficult challenge of reconciling the choir's chant with the pitch level of the organ music, a task was made especially demanding by the absence of true D♯ and A♭ from meantone-tuned French organs of the period.

See also **Subsemitones**

Vincent J. Panetta

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DENMARK

There are four main periods of organ-making activity in the history of Denmark. The first of these periods (1559–1648) was under the reign of the music-loving kings Frederik II and Christian IV, when prominent foreign masters served as royal organbuilders: Hermann Raphaëlis Rodensteen, Hans Brebus, Nicolaus Maass, and Johan Lorentz. Esajas Compenius came to Denmark in 1616 in order to reerect his magnificent chamber organ, the "Compenius organ" (extant) at Frederiksborg Castle.

The second period of importance began at the end of the seventeenth century, when the Botzen brothers established their workshop in Copenhagen. The brothers are most famous for their monumental instrument in the city's Our Saviour's; its grandiose facade still exists. The high Baroque epoch, heralded by these builders, culminated in the years 1724–1744, thanks to the skilled and highly productive Arp Schnitger pupil Lambert Daniel Kastens, who settled in Copenhagen. The work and style of this master was carried on by his former journeymen Hartvig Jochum Müller (ca. 1716–1793) and Amdi Worm (1722–1791). Toward the end of the century these builders were partly superseded by the Polish-Prussian immigrant Daniel Wroblewsky (1744–1818).

The third golden era was the period 1826–1847, when talented builders Jürgen Marcussen and Andreas Reuter built up their renowned firm, creating a number of successful instruments. Thanks to their solid construction and first-class materials, several of the Marcussen and Reuter instruments are still in use, ranking among the most appreciated organ monuments of Denmark. After Reuter's death the firm continued as Marcussen & Son, today the oldest active organ factory in the world.

The last period is that of the pioneer years of the Danish Organ Reform Movement. The reformation of the Danish organ scene was led by Marcussen & Son in southern Jutland and Theodor Frobenius and Sons in Kongens Lyngby, north of Copenhagen. The movement culminated in the years 1940–1970, where progressive Danish builders were celebrating triumphs at home and abroad. The success was rooted in a fruitful collaboration between organbuilders, architects, and musicians, resulting in a neoclassical organ type, characterized by simplicity, craftsmanship, and exquisite design. This organ type, an inspiration to many in the Western world, is often described as neobaroque, but its developers regarded it a sort of universal organ, suited for every type of genuine organ music, new or old.

Other pioneers of the Organ Reform Movement were the organbuilders Poul-Gerhard Andersen, Adolf Wehding, and Sybrand Zachariassen, and the organists Emilius Bangert, Finn Viderø, and Mogens Wöldike. In the early twenty-first century, the six major organ-building firms in Denmark were Marcussen, Frobenius, Carsten Lund, Bruno Christensen and Sons, P.-G. Andersen and Bruhn, and Gunnar Fabricius Husted. A record of twentieth-century Danish organists and extant organs has been maintained since 1906 by the Danish Guild of Organists.

See also **Scandinavia**

Ole Olesen

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DE SWART, PETER JANS (JANSZOON, JANSZ) (CA. 1536–1597)

Dutch organbuilder. De Swart was probably born in Montfoort, but came to Utrecht to take over the workshop of Cornelis Gerritsz[oon; surname unknown] (d. 1559), whose father Gerrit Petersz[oon] (d. 1527) and grandfather Peter Gerritsz[oon] (d. 1480) were also organbuilders. De Swart was probably the most important Dutch builder between 1560 and 1590. He worked in numerous Dutch cities, repairing and rebuilding organs, particularly after the 1566 Iconoclast riots. In 1567–68, De Swart restored the most famous Dutch organ of the time, the Hendrik NIEHOFF organ in Amsterdam, Oude Kerk, later played by Jan Pieterszoon Sweelinck.

De Swart's new organ for Leyden, St. Pancras/Hooglandse Kerk (ca. 1565) had a Hoofdwerk with Principal chorus, Flute chorus, Trumpet, and Zink (a descant reed); a Borstwerk with Flutes (8', 2') and reeds (8', 4'), and a pull-down Pedaal (activating the Hoofdwerk 8' reeds). The organs built for Amersfoort, Onze Lieve Vrouwekerk (ca. 1573) and Brielle (1580–82) would have had similar specifications. The organ for Utrecht, St. Maartenskerk/Cathedral (1569–71) had three manuals: a Hoofdwerk, with an old-fashioned Blokwerk; a Bovenwerk comprising Principals 8' and 4', a Flute chorus, and two 8' reeds; a Rugwerk with a Principal chorus, Flutes 8' and 2', and reeds 8' and 4'; and a Pedaal similar to the Leyden organ. Although no De Swart organs survive, a large number of pipes were incorporated into Utrecht Cathedral (Bätz, 1831).

De Swart was associated with Jan Jacobsz van Lin I; after De Swart's death, his son Dirck Petersz De Swart and van Lin's son Jan Jacobz van Lin II took over the business. When the elder van Lin died in 1622, Dirck took a job as a bailiff. The workshop was continued by Jan Jacobsz van Lin II, but he seems to have lacked the necessary knowledge, leading to the business's demise.

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DETACHED CONSOLE

SEE CONSOLE; MECHANICAL AIDS

DIAPASON

A somewhat elusive term with two applications.

(1) A stop, in fact, two stops: the 8' Open Diapason and Stopped Diapason; these were the FOUNDATION STOPS of English and Anglo-American organ design until the nineteenth century.

(2) A chorus devoted to those stops. The Open Diapason, most often an open cylindrical metal Flute, has a well-balanced blend of partials that allow for just enough "wave motion" within its tone to maintain interest without becoming overbearing. The less common STOPPED DIAPASON is a quadrangular wooden Flute with a stopper set in its top; like a clarinet, the even-numbered partials do not sound, and the Stopped Diapason emphasizes the fundamental, Twelfth (octave and fifth above), and the Tierce, or Seventeenth (two octaves and major third above).

Other nations' organs had similar pipes—the French Montre (8') and Prestant (4'), the Dutch Prestant (replacing the Doef), and the German Praestant or Prinzipal—but the Open Diapason chorus was so pervasive in the U.K. that, in the words of Williams and Owens, "it helped to hinder the development of the English organ." The terminology became more complicated during the Romantic period, when German organ building strongly influenced the English approach. The German *Prinzipal* referred to a Diapason-like (but less forceful) stop. The English term *Principal* referred either to the 4' Open Diapason or the whole Diapason chorus. While nineteenth-century English builders accepted a German-style Principal as the foundation stop, the twentieth century has seen a return to the Open Diapason as the starting point for the English and Anglo-American organ.

See also **Stop**

RICHARD KASSEL

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DIAPHONE

A lingual pipe in the form of a valvular reed. Its first known use was in England around 1888 by Blackett and Howden; however, the first English patent was granted in 1894 to Robert HOPE-JONES, who incorporated it into his Worcester Cathedral instrument (1896).

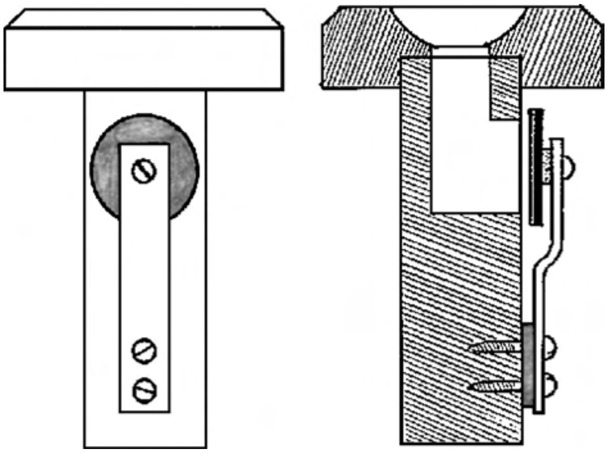

Fig. 28. Diaphone.

The diaphone is designed to utilize the standing wave in the resonator body of the pipe as the predominant control of the speaking pitch. In its purest form the resonator sits on a vibrator assembly (colloquially and inaccurately referred to as a beater box), containing a circular valve on a spring steel arm with the valve located over a circular hole channeled to one end of the resonator body. The circular valve performs the function of a reed tongue while the normally gasketed circular hole leading to a channel up into the resonator performs the function of a shallot. Air flows under the valve face where, according to Bernoulli's principle, reduced pressure from a moving fluid greatly lowers the air pressure, thus causing the valve to move, partially close, and reduce the flow. The spring arm, which may have as much as 100 pounds of resistance to deflection, pulls the valve back open, as the Bernoulli effect stops with the diminished flow. Once the hole is fully open again, airflow is restored and the process repeats in periodic oscillation of the valve.

Ideally, the airflow is controlled by the standing wave in the pipe body so that the valve opens and closes in response to resonator standing wave action. Thus the standing wave action is the main source of pitch determination. This trait allows specifically designed diaphones to perform at two different note pitches. For example, the "Trapdoor Diaphones" in the 32' Pedal of THEATER ORGANS made by the WURLITZER Company uses six pipes for the full twelve-note pedal octave. Low CC has an electro-pneumatically controlled trapdoor that swings open to shorten the resonator length, so that the pipe then speaks at CC♯; in this way, DD goes to DD♯, and so on for the rest of the octave.

Diaphones resonators may be constructed in wood or metal. The 32' is typically wooden in an inverted pyramid shape and can extend up through the 16' octave on stops like the Diaphonic Diapason. Some 16' extensions to the Open Diapason are done in metals, such as zinc or less expensive linen-finished lead. When done in metal the pipes are conical in shape and are often mitered to allow a 16' pitch pipe to fit under a ceiling of lesser height.

Diaphones were included on some theater organs as a power Pedal stop on 25' wind. John H. COMPTON of the United Kingdom continued to develop valvular reed stop extensions long after Hope-Jones's departure for the United States in 1903. He found that very acceptable Pedal stops could be made to sound like other reeds, and even string tone could be generated using the valvular reed. Compton also weighted the beaters to oscillate on a lower pitch, which allowed half-length resonators to operate at one-quarter wavelength for some stops.

While not common, diaphones have been included in some modern organs. The MIDMER-LOSH instrument designed by Emerson RICHARDS at the Atlantic City, New Jersey, Convention Hall (1929–32) featured a 64' Contra Diaphone. The price of the rare wood needed to construct a 32' octave of two-inch–thick boards in square resonators is quite prohibitive, even if the wood can be found and harvested. The weight is prohibitive for all but the best of architectural designs; the weight of a single low CCC wood diaphone of large scale may attain 3,400 pounds. But the prompt speech of diaphones has led to renewed interest in them by firms such as WICKS; in addition, a W. W. KIMBALL 32' Diaphone extension (1920s) was included in the SCHOENSTEIN specification for the organ at the Church of the Latter-Day Saints Conference Center, Salt Lake City. The sheer volume of that space allows this stop to produce the wonderful foundational tone that is the hallmark of a good diaphone.

ALFRED F. SEFL

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DIEFFENBACH

Family of American organbuilders of German background. The Dieffenbachs were active in western Berks County, Pennsylvanis, from the late eighteenth century and throughout the nineteenth century. Operating for four generations near Millersburg (now Bethel), the family was in business longer than most of the Pennsylvania German organbuilders but produced only about two dozen small instruments, most one-manual without pedal, for rural churches. Until the last generation, Dieffenbach organs were distinguished by attrac-

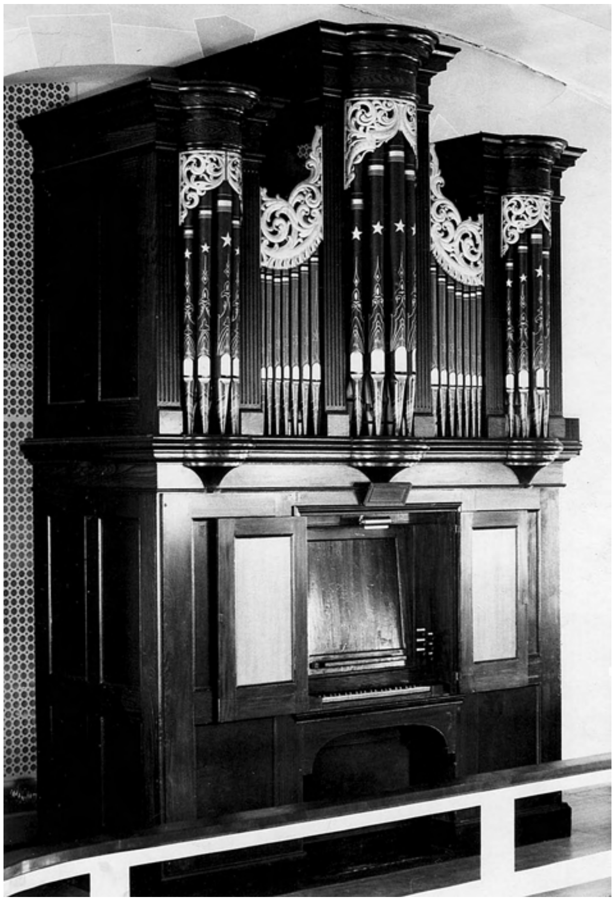

Fig. 29. Dieffenbach organ, 1816 (rest. 1973), Altalaha Lutheran Church, Rehrersburg, Pennsylvania.

tive five-sectioned cases, well-proportioned and with carved pipe shades, in German Baroque style.

American-born John Jacob Dieffenbach (1744–1803) worked as a carpenter and cabinetmaker and was self-trained as an organbuilder; he built an organ for his home in 1776, supposedly after studying and measuring an imported instrument in a Philadelphia church. His son Christian Dieffenbach (1769–1829), grandson David Dieffenbach (1798–1872), and great-grandson Thomas Dieffenbach (1821–1900) were also organbuilders. Their organs were built mainly for small churches in Berks and Lebanon counties but were not produced continuously and did not always engage the builders full-time. The first two generations may well have been influenced by the work of David TANNENBERG, who built in a similar style in nearby Lititz. Two main periods of activity in the nineteenth century may be identified: the first two decades, and from mid-century to 1891, representing the work of Christian and Thomas, respectively. Christian's organs usually included upper work; a typical example contained 8', 8', 4', 4', 4', 3', and 2'. In addition to building new instruments, Thomas often removed mixtures and added pedals to existing organs; he also built at least one two-manual and pedal instrument. David is known to have built only one organ, a four-rank positive.

Records exist for twenty-four organs built by members of the Dieffenbach family between 1776 and 1900. An instrument from around 1800, originally built by John Jacob for a residence, later installed in Epler's Church, Bern Township, was restored in 1984 for the Historical Society of Berks County. A six-rank organ built by Christian in 1808 for the Zion Lutheran and Reformed Church, Orwigsburg, was restored and installed in the Shrine to Music Museum, Vermillion, South Dakota, in 1991. The largest surviving Dieffenbach instrument, built by Christian in 1817 for Altalaha Lutheran, Rehrersburg, and rebuilt (ca. 1886) by Thomas, who added a seventeen-note Pedal stop and a detached reversed console, was eventually returned to its original twelve-stop manual; it was rededicated by the church in 1973.

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DIESIS

In tuning theory, "intervals" that result from the "difference" (ancient Greek) between pure intervals or sums thereof, if the results were to be translated to a twelve-note-per-octave keyboard. There are two kinds; the "greater diesis" is the difference between the sum of four pure minor thirds and an octave; thus $(6:5)^4$ - (2:1) = 648:625, or 62.5 cents (a bit larger than a quarter-tone); the "lesser diesis" is the amount by which an octave exceeds three pure major thirds; thus (2:1) - $(5:4)^3$ = 128:125, or 41.1 cents (a bit smaller than a quarter-tone). The cognates *dièse* (Fr.) and *diesis* (It.) mean "sharp."

See also **Comma; Tuning and Temperament**

DIRECT ELECTRIC

SEE ACTION; WICKS; WINDCHEST, DIRECT-ELECTRIC

DISPLAY PIPES

Those pipes visible to the onlooker from the front of the organ; also called FACADE or front pipes. In many open CHESTS, the pipes are fully functional; in the past, many chests held exclusively silent or "dummy" pipes; a combination of both types is still popular today. In any case, the goal was primarily design-oriented and secondarily acoustic. In organs where there is a display of speaking pipes, these are usually mounted in a case set apart from the WINDCHEST. Wind is supplied to these pipes by means of conveyances such as cylindrical tubes of lead or some other material.

In different eras, one or more ways of plating or painting have been popular: gold or silver gilt, blue paint (a recurring French choice), polished or burnished metal (copper, tin), lacquered or painted zinc, unadorned spot metal, flamed copper (superheated, then quickly cooled to form red oxide patterns), stenciled decoration (decorated mouths, symbols at strategic places), or paintings of rural landscapes and other subjects. Occasionally wooden pipes were used as display pipes, some with painted faux-mouths for effect.

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DISTELEN, DANIEL VAN DER (FL. 1472–1510)

Brabantine (South Netherlandish) organbuilder. Biographical information is virtually nonexistent; Distelen apparently came from Mechlin (Malines) and settled in the nearby city of Antwerp by 1502. Earlier in his career, Distelen ("alter Meister Daniel") built organs at Bergen op Zoom, Cathedral of St. Gertrude of Nivelles (1472; second instrument, 1490), Werchter (1484), Lier, St. Gommerus (1494–97, collab. Hendrik van den Houwe), and Louvain (Leuven), St. Jacob (1492). In 1498 he rebuilt an organ at Vorsselaar, then worked in 's Hertogenbosch, repairing a 1498 van den Houwe organ at St. John.

An anonymous report on Distelen's work (ca. 1502) is the first significant documentation on the builder, describing his approach to tuning, pitch level, Blokwerk and Rugpositief manuals, registration options within the Blokwerk (Principal, Mixture, Scherp [Sharp], and combinations), and winding (incorporating traditional double-fold bellows without note channels). The writer notes the single slider for the Scherp mixture, dismissing it as unreliable. Van der Distelen's plans for a new positive at Antwerp Cathedral were realized by Willem Boets van Heist (1504). His later work includes Zoutleeuw, St. Leonard (1501–06, collab. Jan van Aren; rest. Jan Janszoon van Weert, 1616–20). He also added Pedaal stops to an organ in Meerhout (1505).

While none of his organs survive, Distelen is best known for an adventurous plan he submitted for a guild chapel organ to be built at Antwerp Cathedral (ca. 1505). There were to be three manuals, nineteen stops, a positive-like Borstwerk in addition to the Hoofdwerk and Rugpositief divisions, a variety of reed, mixture, and Pedaal stops spread among the chests, and partial coupling of pedal and manuals. (For the specification plan, *see* LOW COUNTRIES.) Although unbuilt, the plan served as a model for Hans SUISSE's instrument at the same cathedral (1509) and influenced many other builders.

RICHARD KASSEL

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DIVIDED STOP

A register or RANK in which two STOP controls are provided, one of which accounts for the lower octaves (i.e., lower half) of the KEYBOARD, the other the upper octaves. Both controls must be engaged in order for the register to play throughout the full compass. The system may be applied to whatever registers or ranks are chosen by the builder, in whatever combinations are available. This arrangement is most often found on smaller instruments, where the player might want to play one timbre in the left hand and a different one in the right hand (e.g., a SOLO stop). They were a signature of Iberian organs up through the classical era, but appeared in other national styles with varying degrees of frequency. A solo stop limited to the upper half of the organ's compass is called a HALF-STOP.

DIVISION

A section of an organ's pipes (and its associated wind, action, and tone-producing technology), usually comprising several RANKS in one CHEST, in theory controlled by a single KEYBOARD or PEDALBOARD. COUPLERS and other mechanical and electronic devices increase the possibilities far beyond single-manual control. A "floating" division, on the other hand, may be played from more than one manual, depending on the technology available; it lacks a true "home keyboard." Within the organ CASE, each division usually had its own chest(s) to contain the necessary pipework.

The earliest division was probably the BLOCKWERK (Dutch *Blokwerk*), the large medieval church organ's undivided chest, each KEY controlling several ranks but without the ability to open or stop them, resulting in a single loud MIXTURE. (The term *Blockwerk* was bestowed by later organ theorists.) The POSITIV (Ger.; Fr. *Positif*; Dutch *Positief*), also of medieval origin, started as a smaller, freestanding one-manual instrument (the POSITIVE), often found in the form of a HOUSE ORGAN and used for religious or secular music (Landini, fourteenth century). It evolved into the RÜCKPOSITIV (Ger.; CHAIR ORGAN; Fr. *Positif de dos*; Dutch *Rugpositief*), the chest and manual of which were located behind the player seated at the main CONSOLE, requiring the performer to turn around to face its keyboard. The Rückpositiv function was incorporated into the main case as the Positiv division, although it continued to have its own manual (e.g., CHOIR organ) and often its own chest. The Positiv introduced the slider-chest, with the possibility of opening or closing up ranks, to keep them or stop them from sounding.

The technological synthesis of these two divisions produced the HAUPTWERK (Ger.; GREAT; Fr. GRAND ORGUE; Dutch *Hoofdwerk*), the instrument's primary manual, with its chest located above the player (hence its early designation as the OBERWERK; Dutch *Bovenwerk*). Again, the term *Hauptwerk* was applied centuries after its actual development in the late medieval era. The Hauptwerk distilled the ranks of the Blockwerk, containing the all-important PRINCIPALS, with other tonal combinations determined by stopping and opening ranks. Eventually, the Oberwerk, when present, became a Positiv-like division often resembling the Hauptwerk but with less power and brilliance.

The term BRUSTWERK ("breast department"; Dutch *Borstwerk*) was applied by subsequent generations to (1) the Hauptwerk (Oberwerk) itself; (2) the integrated Rückpositiv, now located in a chest between the console and the Hauptwerk; or (3) a chamber division (at times a REGAL; Ger. *Schnarrwerk*), similarly located. In the latter two examples, the subsidiary Brustwerk might have its own keyboard or be controlled by the Hauptwerk manual or even the pedalboard. Introduced in the Renaissance, it would at times take on the function of a Swell division.

The PEDAL (Fr. *Pédale*; Dutch *Pedaal*) division itself did not take its archetypal tower form immediately; indeed, the "pedal" of the early Renaissance was a hook or lever to hold down drones. The PULL-DOWN mechanism of the later Renaissance allowed the pedalboard to control manual stops (not necessarily an instrument's lowest ranks), even functioning as a coupler. Gradually the Pedal became an independent "bass division," although its stops might be playable elsewhere, while upper work became part of their sonority, in part to perform chorale and other melodies. The symmetrically placed PEDAL TOWERS became a signature of cathedral and larger church instruments (although nineteenth-century French builders placed the division behind the organ case).

At the top of the Hauptwerk case, German and French builders placed the relatively small KRONWERK/POSITIVE DE COURONNE ("crown department"; sometimes called an Oberwerk). In the case of the SOLO (Fr. RÉCIT) division, the chest was placed behind the upper part of the Hauptwerk, but carried the most penetrating and singular solo stops. Later, the most distinctive stops were placed in other chests or their own, sometimes unenclosed chest. The Kronwerk sometimes became an ECHO division, suitably adjacent to the Hauptwerk it "reflected." On rarer occasions, a large instrument might have a so-called antiphonal division, with its chest isolated from the others, sometimes at some distance.

The concept behind the Swell division, usually a moderately sized chest, could be applied to any other division; mechanical or other means would open and close shutters in front or on top of an enclosed chest, producing gradual dynamic changes ("expression"). Originally developed in Iberian Baroque organ building, then popular in England and France, the Swell came to replace the Positiv most often; the Romantic organ proved to be the heyday of this division.

See also **Grand choeur; Unterwerk**

RICHARD KASSEL

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DOBSON

American organ-building firm. Dobson Pipe Organ Builders was founded by Lynn Dobson, born in Carroll, Iowa, in 1949; it specializes in tracker organs. Dobson attended Wayne State College in Nebraska, graduating in 1971 with majors in art and industrial education. During his college years, he built a twelve-stop mechanical action organ, eventually sold to Sioux City, Iowa, Our Savior's Lutheran (in use). Dobson worked for the HENDRICKSON ORGAN COMPANY in 1974 before establishing his own firm in Lake City, Iowa, where it remains. Early projects included commissions for the Minnesota institutions Olivet Congregational, St. Olaf College, and Bethany College.

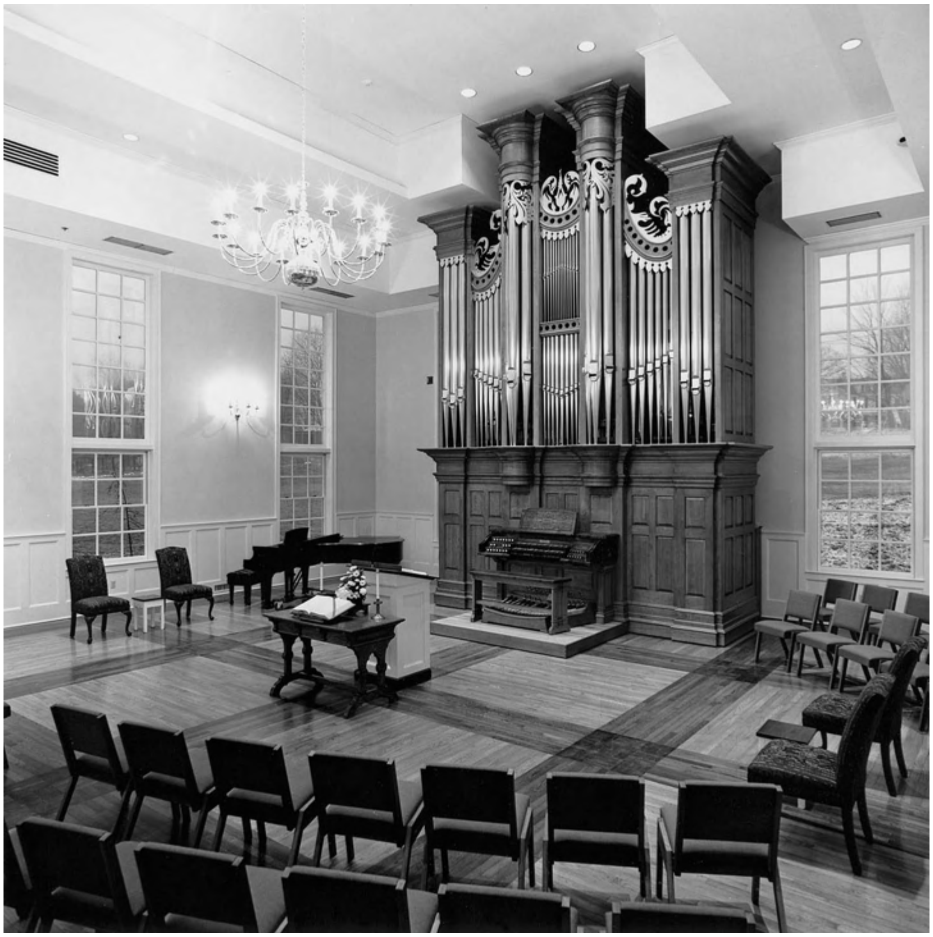

Fig. 30. Dobson organ, op. 69 (2/25), Pakachoag Church, Auburn, Massachusetts.

In the 1980s Dobson was engaged by the Westminster Presbyterian Church of Des Moines, Iowa, to complete the unfinished Lawrence I. PHELPS organ. He then built instruments for Lake City Union Church; two-manual organs—for Stillwater, Minnesota, St. Michael's, and Manhattan, Kansas, First Presbyterian. He expanded his sphere of activity to include New York, North Carolina (Burlington, Holy Comforter, 1985), Pennsylvania, Virginia, and other Midwestern states.

Dobson has focused on instruments for church use. In the 1990s, the firm built instruments for Grand Rapids, Michigan, Calvin College; Minneapolis, Augsburg College; Dubuque, Iowa, Wartburg Theological Seminary; Mesa, Arizona, First Methodist (three manuals; Solo on 6' wind as third division); and Auburn, Massachusetts, Pakachoag Church (case inspired by Bernard Smith).

Although Dobson has produced specialized instruments such as the Italian-style organ for Indiana University in Bloomington, most have an eclectic design. Earlier instruments explored the neoclassical aesthetic; recent work has become more complex, blending both classical and Romantic influences. A significant step on this path was the construction in 1992 of a large two-manual organ for Kalamazoo, Michigan, St. Luke's Episcopal, based in nineteenth-century English style but able to perform a broad literature with fidelity. The organ at Minneapolis, St. Paul's Episcopal, combines classical and Romantic elements, as does that of Greensboro, North Carolina, West Market Street Methodist (collab. M. J. Rosales). A more classical course was taken with the organ at St. Benedict, Louisiana, St. Joseph Abbey.

Dobson had its first opportunity to build a significant organ at a major site when it was contracted to design and build a 105-rank organ for Los Angeles, Cathedral of Our Lady of the Angels. Design commenced in 1997, installation began in January 2002, and voicing was completed in early 2003. The firm's current project, for Verizon Hall (the performance venue of the Philadelphia Orchestra) in the Kimmel Center for the Performing Arts, Philadelphia, will result in the largest mechanical action organ in North America (4/126; collab. Rosales; due 2006).

LYNN A. DOBSON

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DODD, JOSIAH E(USTACE) (1856–1952)

Australian organbuilder. Born in the Melbourne suburb of Richmond on 16 August 1856, Dodd apprenticed in 1869 to George FINCHAM for seven years. In 1881 he moved to Adelaide, South Australia, to work at a Fincham branch directed by Fincham's partner Arthur Hobday. Dodd later managed the Adelaide branch from 1888 to 1894, when he purchased the business and set up a firm under his own name. The firm expanded quickly, and his instruments were widely sought by clients in five Australian states and New Zealand. He was later joined in partnership by his sons Ebenezer D. Dodd and D. Eustace Dodd.

Following the establishment of his own firm, Dodd quickly forged a new and progressive organ-building style based upon unison registers of varied tonality, using imported pipework from such English suppliers as Carlton C. MICHELL and Alfred Palmer and mechanical components from LAUKHUFF in Germany. His instruments were of an advanced symphonic style with a rich palette of large-scale diapasons, narrow-scale strings, bold flutes, and vibrant reeds, sometimes voiced on heavy wind pressures. He was the first Australian organbuilder to employ stopkeys and adjustable combination actions for consoles. While the majority of his large organs employed tubular-pneumatic actions, he valued the use of mechanical action for small organs, using this up to 1929. His larger instruments were conceived on generous lines, with distinctive casework, often incorporating three pipe towers and double-story flats.

Josiah E. Dodd's firm amalgamated with the Gunstar Organ Works in 1942. Dodd finally retired from organbuilding in 1948, at the age of ninety-two, and died in Glenelg, South Australia, on 30 January 1952. The firm was taken over by George Stephens (1980) and continues under the Stephens name.

Notable instruments by the firm included Norwood, South Australia, Clayton Congregational (1897), Kent Town, South Australia, Methodist (1898), University of Adelaide, Elder Hall (1901; 3/33), Napier, New Zealand, St. John's Anglican Cathedral (1907; 3/34), Perth, St. Mary's Catholic Cathedral (1910), Launceston, Tasmania, Paterson Street Methodist (1912; 3/37), Lismore, New South Wales, St. Carthage's Catholic Cathedral (1912; 3/38), and Darlinghurst, New South Wales, First Church of Christ Scientist (1926; 3/38).

JOHN MAIDMENT

DOLCAN

A stop, considered the precursor to the modern Dulciana, dating from around 1580 in the Netherlands and northern Germany. The pipes of the Dolcan are inverted conical metal, or occasionally inverted pyramidal wood. Only a few flue stops are always made of inverted conical pipes (wider at the top than at the bottom), and the Dolcan is the most common of these. Found at 16', 8', or 4' pitch, its tone resembles that of the Dulciana, but is brighter and more open. It is not often made, as many builders consider its tone of insufficient distinction to justify the additional cost of construction and the extra space it requires on the windchest. Synonyms include Dolkan, Tolkaan, and Trichterflöte. The accompanying illustration is by Audsley.

See also **Stop**

EDWARD L. STAUFF

DOLCE/DOUCE

A general term for any soft flue stop (especially in the seventeenth and eighteenth centuries), usually narrow-scaled, sometimes equated with Flauto Dolce; found at 16', 8', or 4' pitch. The ambiguity of the term is such that it has been used for wood or metal, cylindrical or conical pipes belonging to foundation, string, or flute stops.

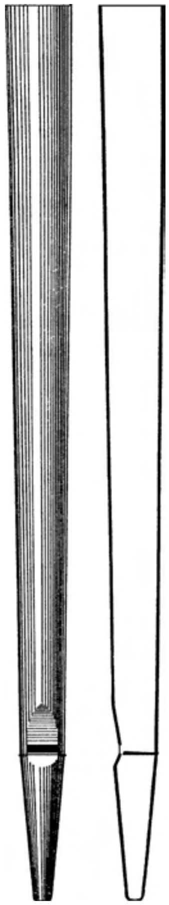

Fig. 31. Dolcan.

DONATI (DONAT)

Family of Saxon organbuilders. Christoph Donati the Elder (b. Marienberg, 30 Sept 1625; d. Leipzig, 14 Aug 1706) was active as an organbuilder in Leipzig by 1653, and was granted citizenship there in 1662. Among the twenty or so organs he built are those for the Bayreuth Stadtkirche (1653, collab. M. Tretzscher), Neuenkirchen (Lower Saxony; 1661–62), Meissen Cathedral (1667), Luckau, Cathedral of St. Nicolai (1672–74), Thuringia, Eisenberg, castle church (1683–88; collab. J. Krieger and J. P. Krieger), Grimma (1686), Leipzig, Neukirche (1702–04; specification published by Mattheson), and Brandis (1705). He was well-respected in Leipzig, serving as godfather to the children of, among others, Werner Fabricius. He also built clavichords. Christoph Donati the Younger (chris. Leipzig, 2 December 1659; d. there, 14 June 1713), son of Christoph Donati the Elder, worked with his father and succeeded him, though none of his own instruments are known.

Johannes Jacobus Donati the Elder (chris. 27 June 1663; d. Zwickau, ca. 1733), another son of Christoph Donati the Elder, was listed as court organbuilder for Gotha and Altenburg (1701). In 1704, he became a citizen of Altenburg; by that time he was directing his father-in-law Severin Holbeck's (ca. 1647–1700) workshop in Zwickau. Both Christoph Thielemann and Wahlfried Ficker worked for him. In addition to being an accomplished and versatile musician, he built numerous many organs and included unusual stops (Quintatön, Zimbelstern, Flauto Traverso, Regal, Schalmei 4' in the Pedal); he seems to have preferred rather sharp voicing. The surviving instrument in Schlunzig/Glauchau (1724) provides a good example of his skill. Like his father, he also built clavichords, one of which (ca. 1700, with an early example of a complete chromatic bass octave) is housed in the Musikinstrumentenmuseum Leipzig. Johann Jacob Donati the Younger (chris. Zwickau, 15 Oct 1715), son of Johannes Jacobus Donati the Elder, directed the family firm after his father's death. The organbuilder Johann Jacob Schramm (1724–1808) apprenticed with him.

Johann Christoph Gottlob Donati (chris. Leipzig, 19 Oct 1694; buried Glauchau, 8 Sept 1756), son of Christoph Donati the Younger, apprenticed with Johannes Jacobus Donati the Elder in Zwickau; after 1726, he was active in Glauchau. In 1740 he was assistant judge at the district courts. The fine organ built for the Schlosskapelle in Lichtenwalde (1740–41) was moved to the Stiftskirche, Ebersdorf, in 1962. His sons Christian Gottlob Donati (chris. Glauchau, 3 Aug. 1732; d. Altenburg, 13 Nov. 1795) and Gotthold Heinrich Donati (chris. Glauchau, 24 Oct 1734; d. Altenburg, 28 Dec. 1799) took over their father's workshop and became citizens of Glauchau in 1770. In December 1771, Christian Gottlob was named royal organbuilder to the prince of Saxony; the following year, the two brothers moved to Altenburg. Gottlob Heinrich continued the workshop after his brother's death. Some of their organs survive at Neuen Mörbitz (1770), Wettelswalde (1793), and Böhlen (1794). Johann Christoph Donati (chris. Glauchau, 21 Dec. 1737; buried there, 15 Jan 1764), another son of Johann Christoph Gottlob Donati, worked as a skilled craftsman in the family business, but did not complete any instruments of his own. Another son, Carl Friedrich Donati (chris. Glauchau, 2 May 1740; d. there, 2 Feb. 1814), was a cabinetmaker, and named a citizen or freeman of Glauchau in 1774; he was only casually associated with organ building.

August Friedrich Wilhelm Donati (b. Altenburg, 21 May 1773; d. there, 1 Feb. 1842), son of Christian Gottlob Donati, was appointed the Altenburg Court organbuilder in 1800. In 1805 he renovated the organ in the Eisenberg castle church, which his great-great-grandfather Christoph Donati the Elder had built in the 1680s.

Although the instruments of Christoph Donati the Elder show North German influences, the work of his descendants were increasingly in the style of Gottfried Silbermann, including case designs, key lengths, drawstops, windchests, and the action for both manuals and pedal. Several beautiful cases still survive, such as those in Wettelswalde, Schlunzig, and Ebersdorf.

Douglas E. Bush

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DONNER/STURM/STORM OR THUNDER PEDAL

A nineteenth-century "combination stop" employed by Aristide Cavaillé-Coll, E. F. Walcker, and Gray And Davison (and, anachronistically, by Laukhuff and Moller in the mid-twentieth century). The lowest six or seven Pedal notes are drawn successively by a separate pedal, especially effective when a 32' reed rank is involved. At least one wag suggested this de-

vice to be superfluous, as one could get an even greater effect by sitting on the keys.
See also **Orage**

DOPPELFLÖTE

A wooden stop with two mouths, located on opposite sides of the pipe. It is nearly always found at 8′ pitch. Authorities disagree on whether it is open or stopped, but the stopped construction seems to be the more common, particularly in the 1800s. It was mentioned by Michael PRAETORIUS as early as 1619; according to Williams, it was frequently found in Silesia from the 1600s through the 1800s. It was never popular in England, but in the United States was a favorite of the Roosevelt brothers. Its tone has been described as full, strong, pure, round, and liquid. Some sources criticize it as being hooting. It is chiefly a solo stop; authorities disagree as to how well it blends with other stops. Because of its two mouths, the Doppelflöte requires more than the usual amount of space on the windchest. The double-mouth construction is usually abandoned in the 8′ octave in favor of a normal single-mouth construction. The accompanying illustration is by George A. AUDSLEY.
See also **Stop**

EDWARD L. STAUFF

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DOPPIO PEDALE

An Italian term (meaning "double pedal") to identify passages in which both feet are performing simultaneously on the PEDALBOARD. The compositional device was used predominantly in Germany, as early as the fifteenth century.

Examples of early use of doppio pedale in Germany include the Adam Ileborgh TABLATURE, a fifteenth-century manuscript. Arnolt SCHLICK composed a setting of the chant *Ascendo ad patrem* for ten voices, six in the manual and four in the pedal. Ludwig Senfl composed a *Preambulum six vocum* found in a tablature book from around 1550, discovered in Klagenfurt, which contains four parts for manual and two parts for the pedal (see Apel). in the *Tablatura Nova*, III. Samuel Scheidt (1587–1654) composed two settings requiring the use of double pedal: *Modus Ludendi Pleno Organo Pedaliter a six vocum*, and *Modus Pleno Organo Pedaliter* (*Benedicamus a sex vocum*).

Other German Baroque composers using doppio pedale were Franz Tunder (1614–1667), Matthias

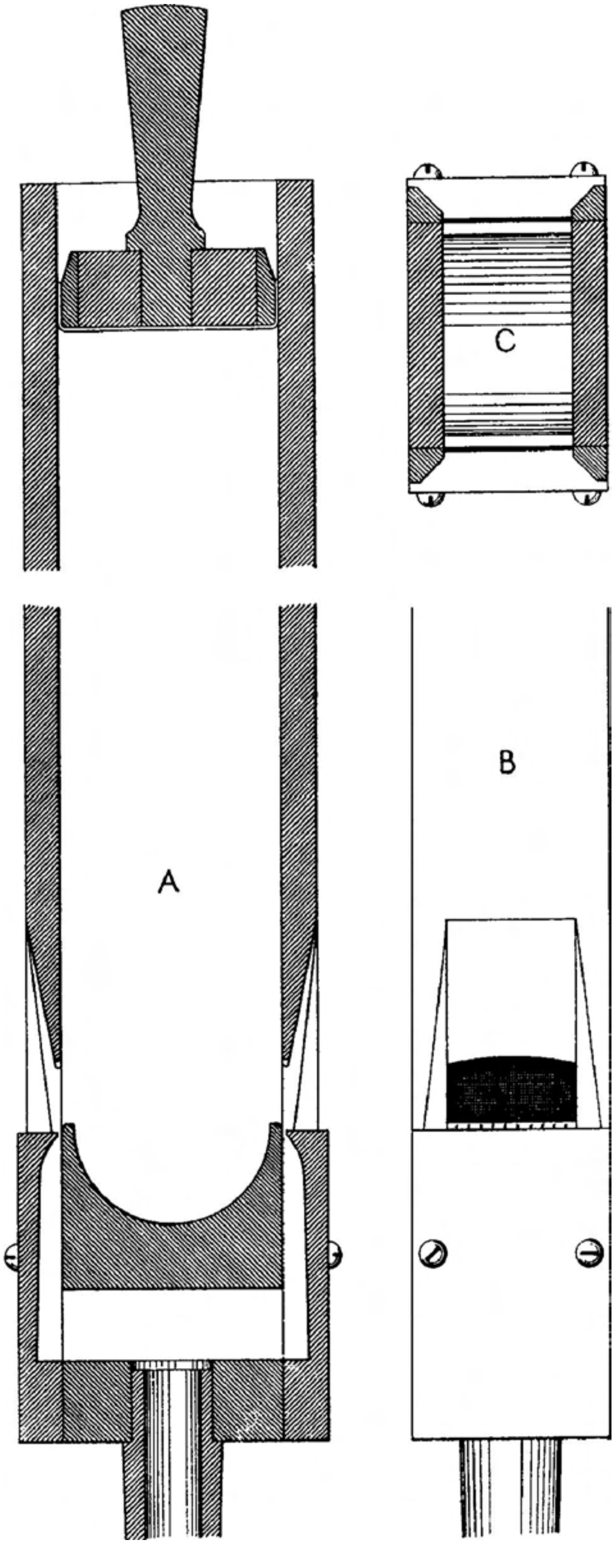

Fig. 32. Doppelflöte.

Weckmann (1621–ca. 1674), Johann Adam Reincken (1623–1722), Nicolaus Bruhns (ca. 1665–97), and Vincent Lübeck (1654–1740). Organ works by Johann Sebsatian Bach employing double pedal include the Praeludium in G Major, BWV 568; Praeludium in A Minor, BWV 569; Concerto in G Major (after J. E. Prinz), BWV 592; Concerto in A Minor (after Vivaldi), BWV 593; "Aus tiefer Not" (*Clavierübung* III), designated *in Organo pleno con pedale doppio*; "An Wasserflüssen Babylon," BWV 653b (Weimar version), marked *a 5 parti con 2 tastiere e pedale doppio*, and "Jesus Christus, unser Heiland," BWV 665a. In France, two notable composers used double pedal on occasion: François Couperin (the ORGAN MASS *des paroisses*) and Louis Marchand (1669–1732) in a six-voice PLEIN JEU (*Pièces d'Orgue* I).

Later composers have employed double pedal for a variety of compositional purposes. Franz Liszt and Max Reger expanded the technique to the playing of tone clusters, as many as three, even four chromatically arranged notes to be played with each foot simultaneously. Later composers have continued to explore further uses of double pedal technique: William Albright, Hendrik Andriessen, Henk Badings, Paul Cooper, J. N. David, Edward Elgar, Pozzi Escot , P. R. Fricker, Bengt Hambraeus, Iain Hamilton, Anton Heiller, György Ligeti, Frank Martin, Vincent Persichetti, H. L. Schilling, and Alan Stout.

MARTHA FOLTS

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DOS SANTOS

Portuguese family of builders active during the nineteenth century. The family, which included Luiz António dos Santos, his son (Peres) António José dos Santos, and his grandson Artur Alexandre dos Santos, was active in Mangualde, Viseu. Luiz António built a stylistically retrospective Baroque instrument at Viseu, Cathedral (now Seminário; 1808); according to Artur Alexandre, he may have worked at Mafra with António MACHADO E CERVEIRA on the organs for the royal basilica there (1806–7). António José rebuilt a two-manual Baroque positive by Manoel Lourenç da Conceiçao at Porto, Evangelho, with most of the original stops (rest. Flentrop, 1969–71). Other restorations by António José include Porto, Grilos Church (1860); Porto, S. João Novo (1867); Porto, S. Bento da Vitória, 1716–22 G. Rodriques organ (1880; rest. Flentrop 1969–71); and Porto, Cathedral, ca. 1727 epistle organ (1869; rest. Flentrop 1969–71). He built new organs for Porto, S. João da Foz (1868) and S. Francisco (1873). In 1899, the dos Santos firm moved two organs from Porto, S. Bento da Ave-Maria (including the 1817 Sá Couto) to the Bonfim church near Porto, combining the two organs (with additions) into one instrument.

RICHARD KASSEL

DOUBLE BASS

SEE CONTRABASS/DOUBLE BASS

DOUBLED PIPE

A family of stops whose pipes have two mouths, located opposite one another, dating back to at least 1500; also called double organ pipes. The additional mouth means that the pipe needs more space on the windchest and receives greater WIND PRESSURE.

The DOPPELFLÖTE, known to Michael PRAETORIUS, is a wooden, stopped 8' pipe. Chiefly a solo stop, its tone has been described as full, strong, pure, round, liquid, and good at blending; detractors find it "hooting." Other examples of doubled pipes are: Doppelgedackt (or Doppelrohrgedackt) and Doppelflötenbass (stopped, wood); Doppelrohrbordon, Doppelrohrflöte, and Doppelrohrgedackt (half-covered, wood); Philomela (not the "nightingale" stop, but larger; open, wood); Seraphon family (open, metal; two adjacent mouths rather than opposite one another); Bifara, Ludwigtone, and Flute Coelestis (one mouth set slightly higher than the other, producing the "celeste effect"; the latter two had a wall inside their pipes to create separate air columns); and the Stentophone family (metal; single mouth cut halfway through pipe circumference).

Doubled pipes should not be confused with "double stops," usually 16' versions of typical 8' stops (i.e., sounding an octave lower than usual).

RICHARD KASSEL

DOUBLE DRAW

A stop in which the DRAWSTOP can be pulled out halfway (half draw, first position) to put on one rank; pulling it out the rest of the way (full draw, second position) adds an additional rank. Double-draw stops allow for subtle changes of color and dynamic level.

Examples of the double draw in the treble register include the Nasard/Cornet II and Sesquialtera stops; in the half-drawn position, the 2-2/3' rank (Twelfth) is put on; the full draw adds the 1-3/5' rank (Seventeenth), to form an "open root position" series, for example, g/e^1 above fundamental C.

DOUBLE ORGAN

A term of uncertain origin and flexible meaning; a single-manual instrument might have been called a "pair of organs" in the fifteenth century. In the following century, this term was applied to a KEYBOARD with extended compass as well as instruments with two sets of pipes or two manuals. In any case, by the 1600s, the meaning had evolved to its final form: an organ of at least two manuals (and, eventually, a PEDALBOARD). English double voluntaries specifically written for this instrument do not call for separate CONSOLES; indeed, the flexibility of a multimanual console, the disappearance of the antiquated CHAIR ORGAN, and the use of DIVIDED STOPS made the notion of two consoles superfluous. However, works for two organs were written (notably by Lodovico Viadana and Luigi Cherubini), and two-console instruments exist to this day. The "double organ" should not be confused with the spatially divided organ/choir arrangement (St. Mark's, Venice) fundamental to late Renaissance antiphonal music and beyond.

RICHARD KASSEL

DOUBLE SHARPS (SPLIT KEYS)

SEE SUBSEMITONES

DOUBLE TOUCH

A KEY ACTION in which the lever comprises two sets of electrical contact points, or pivots. The lever (often spring-supported) is designed so that pressing a key past its customary contact point engages additional stops or couplers, automatically transferring from one pivot to another as a function of the amount of depression of the key (which the player experiences physically). Release of the key cuts out the individual ranks. Associated primarily with the THEATER ORGAN, this device is not the same as the more prevalent double action piston (reversible).

See also **Mechanical aids**

RICHARD KASSEL

DOUBLETTE

The 2' Principal rank (4' in the Pedal) of the French classical organ. The pipes are of open cylindrical metal construction.

DRAKE, WILLIAM (B. 1943)

British organbuilder of American birth. Born in Baltimore on 2 October 1943, he served his apprenticeship with RIEGER in Schwarzach, Austria (1963–66), then worked as a journeyman in Germany. In 1974 he founded a firm in Buckfastleigh, Devon. Drake specializes in historically informed restorations and reconstructions of eighteenth- and early-nineteenth-century British organs. The firm has restored instruments at Exeter, St. Olave, (1847 Joseph Walker organ, 1985); Dorset, Lulworth Castle (1785 R. Seede organ, 1986–89); Totnes (Devon), St. Mary's Priory (1861 Henry Willis organ, 1988); London, Buckingham Palace, ballroom (H. C. Lincoln organ, formerly Brighton, Royal Pavilion, 1999); and London, Christ Church Spitalfields (1735 Richard Bridge organ, in progress).

Drake's new instruments include Sudbury, Massachusetts, St. Elizabeth (1989); London, Mayfair, Grosvenor Chapel, using 1732 Abraham Jordan case (1991); Oxford, Jesus College (1993); London, Palace of Westminister (1999); and Abergavenny, St. Mary. He has also installed organs in Wales, Ireland, Luxembourg, and New Zealand. His instruments have incorporated Tierce and Quint alternatives in mixtures and transposition ability in continuo organs. Drake has published articles in the *BIOS Journal* and the *Organbuilder*.

RICHARD KASSEL

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DRAWSTOP

The knob, lever, or tilted tablet that operates the STOP mechanism on the CONSOLE; also called a stop-knob. This Renaissance mechanical device, accessible to the performer without leaving his or her bench, made it possible to perform without having a second person shift SLIDERS on the side of the organ to change stops in the now-divided BLOCKWERK. It uses levers and trundles to accomplish its goals. The tilted stop tablet, a product of electric action, changed the push-and-pull of the mechanical stop-knob into an on-off switch.

Richard Kassel

DREHORGEL

The German term for the hand-operated barrel organ.

See also **Mechanical organ; Player pipe organ**

Ferdinand J. de Hen

DRUM PEDAL

An accessory consisting of two or more large, loud, stopped wooden pipes, intended to give the effect of kettledrums when played staccato. The pipes were often tuned at an interval of a fifth, apparently intended to be played independently, in imitation of the typical seventeenth- and eighteenth-century usage of a pair of kettledrums. It was known as Pauke/Trommel in Germany and Tambor in Spain.

See also **Orage; Stop**

Edward L. Stauff

DULCIANA

From Latin *dulcis* ("sweet"), a Dulciana is a diminutive Diapason of English origin, smaller in scale than a normal Diapason, and softer and more delicate in tone (often the softest stop in a particular organ). The name dates from around 1640, when it was used for gentle flue stops of various forms. It was introduced to England in 1754 by John Snetzler, who probably encountered the name while working in Austria. It brought him great acclaim, and was soon a favorite of English organbuilders. Eventually English builders apparently grew tired of the tone of the Dulciana, and began voicing it with a stringy tone, or even a hornlike tone like the Keraulophone. In 1905 Wedgwood wrote without remorse that "the real Dulciana is rapidly becoming obsolete, yielding its place to the Salicional."

While the earliest examples of the Dulciana were most often at 4' pitch, the English form is most often found at 8' pitch, though 16' examples are not uncommon and 32' and 4' pitch not unknown. The true English Dulciana is invariably made of cylindrical open metal pipes of small scale, though the scale may vary considerably, from 3' to 4.5' at 8' C. The 8' octave is occasionally made of wood, sometimes stopped wood, and, when space or funds are limited, borrowed from another stop, usually the Stopped Diapason (although it is impossible to get the proper tone from a stopped pipe). While most sources agree on the definition of the Dulciana as a diminutive Diapason, and not a string, Skinner felt that, although its origin was as an Echo Diapason, it should be classified as a muted string, on account of its scale. Synonyms include *Dulciane* and *Dulcian*; the latter is also a synonym for Dulzian, a reed stop.

See also **Stop**

Edward L. Stauff

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DULZIAN

The names *Dulzian*, *Dulcian*, *Dulciaan*, *Doucaine*, and other variants have been given to soft-toned reed stops in a variety of forms. Most names refer to an old double-reed instrument, an ancestor of the bassoon, which some examples of this stop are intended to imitate. It has been made with either free or striking reeds, and with short resonators (1/8 to 1/4 length) of inverted conical or cylindrical metal, or of straight or pyramidal wood. The resonators are sometimes fully or partially capped. Authorities disagree as to whether its scale is small or large. Its tone is most often described as being similar to the Bassoon. It can be found at a variety of pitches, but usually 8' or 16'. The names Touzyn, Toussein, and Douseynen were early synonyms dating from around 1510. The names *Dulcian* and *Dulciane* are also synonyms for Dulciana, a flue stop.

See also **Stop**

Edward L. Stauff

DUPLEXING

See Extension Organ; Player Pipe Organ

DURNER, CHARLES F(RIEDRICH) (CA. 1838–1914)

American organbuilder of German birth. Born Karl Friedrich Dürner, he was trained in Germany. At fourteen years of age Dürner was apprenticed to the Goll family, to which he was related, in Weilheim and Kirchheim (Württemberg). In 1859 Dürner emigrated to the United States, changed his name to Durner, and founded a business in Zion Hill; two years later he moved to Quakertown, Pennsylvania. His brother J. Christian Durner joined the firm, and his son C. Edward Durner continued business after Charles's death (to 1932).

Durner, the first organbuilder to establish a factory in Pennsylvania on a full-time basis, was one of the first builders to introduce "assembly-line" organs to the market. He proved that pipe organs could be sold inexpensively but with good quality. His customers were mainly small churches, which he equipped with standard, mostly two manual and pedal organs of nine to twelve stops.

Martin Kares

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E

EAR

Vertically projecting plate or tab, made of lead or other metal, in pairs, attached at the left and right of the MOUTH (or just below it) in some flue pipes. They aid in focusing the wind onto the upper lip and stabilizing the tone, thereby becoming a VOICING tool. The anthropomorphic English term is equivalent to the German *Seitenbart*, making clear the ear's functional similarity to the BEARD, which is sometimes affixed to the ears (BOXBEARD). The device is used in lower-register pipes (to offset large mouths), narrow-scaled string pipes (to suppress OVERBLOWING), and stopped metal pipes. Some ears have their own smaller "ears" as a further refinement.

Richard Kassel

EARLE, GEORGE W. (1835–1918)

American organbuilder. Born in New York on New Year's Day, 1835, Earle apprenticed to Hook & Hook in Boston. By 1863, he had returned to New York, becoming a resident of Riverhead, New York, in 1870. He built a factory and, from 1872 to 1874, was involved in a partnership with Ahaz Bradley. Earle moved his business, first to Cold Spring Harbor, Huntington, New York, (1877), then to Hempstead, New York, (1884); his factory was destroyed by fire in April 1890. Earle took his son, George W. Earle Jr. (b. Massachusetts, ?1858; d. Hempstead, NY, 17 June 1936), as a partner; the younger Earle succeeded him as the firm's president. Earle's largest instruments were built for Spring Street Presbyterian and St. Luke's Episcopal (1871), both in New York City. George W. Earle died in Hempstead on 21 May 1918.

Stephen L. Pinel

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EAST PRUSSIA

East Prussia (Ostpreussen) has been primarily under German or Polish rule during its history. The defeat of the Teutonic Order State at the battle of Tannenberg (1410) and the scorched-earth sweep of the Russian army at the end of World War II have been major factors in the destruction of much of its organ legacy. But the earliest information on organ building in East Prussia dates from 1333 (Königsberg [now Kaliningrad, Russia], Cathedral), and a reasonably historical clear picture can be drawn. (All former German city names are followed by current Polish names unless indicated.)

For the fourteenth century there is conclusive evidence of organs in Thorn (now Torún; 1342–50), Marienburg (Malbork; 1344), Marienwerder (Kwydzyn; 1350), Frauenburg (Frombork; 1380), Danzig (Gdansk; 1385), Bartenstein (Bartoszyce;

1393–95), and Elbing (Elblag; 1397). Remnants of a Gothic organ were stored at the Protestant parish church in Bartenstein (destr. 1945); this Blockwerk organ had three stops—Principal 16', Octave 8' and 4', and Mixture (6-18 ranks)—with twenty-seven manual keys (F, F-sharp, G-a'), a pedalboard of indeterminate compass, and wind provided by twelve forge bellows. The fifteenth century evidences the presence of organs in many village churches. Larger city churches (e.g, Danzig and Elbing) often owned two organs, the larger at the west or north side of the church.

In the early sixteenth century, organ building in East Prussia, now the Duchy of Prussia, received a fresh impetus. The organs by Hans Haug, Konitz (Chojnice) in Braunsberg (Braniewo) and Danzig represent the transition from Gothic Blockwerk to the Renaissance stop organ. Parts of some Raug instruments survived until 1945. Organs in Königsberg were built by "Jacob Orgelmacher" (1507), Jürgen Engelwein (1539), and Valentin Petsch (1571); the original contract for Petsch's organ at the castle chapel is extant—the oldest document of its kind for East Prussia—indicating a twenty-four-stop instrument on Great, Rückpositiv, and Pedal.

The first half of the sixteenth century saw the introduction of the Reformation into Prussia; Duke Albrecht the Elder (1490–1568) was a personal acquaintance of Martin Luther. The wave of conversion provided much impetus to Protestant church music and its organ accompaniment. The organ building family Zickermann—Adrian (born in Kammin/Pomerania) and his three sons Johann, Joachim, and Adrian the Younger—built important instruments between 1550 and 1623. Their 1587 organ at Königsberg Cathedral was one of the largest organs of its time (3/59), with fifty-nine stops on three manuals and a pedal. (J. A. Friese had built an instrument for St. Mary's, Danzig, with fifty-six stops, one of them a Mixture of twenty-four ranks, two years earlier.) Other Zickermann organs of importance were installed at Königsberg, Altstädtische Kirche (1574–95), Insterburg (Chernjachovsk, Russia), Luther Kirche, and Memel (Klaipeda, Lithuania), Deutsche Kirche (1596). All were rebuilt in the eighteenth century.

Merten Friese, who dominated organ building in Danzig during the first half of the seventeenth century (e.g., St. Trinity's, St. John's, and St. Bartholomew's), worked in Königsberg in 1632 and Insterburg in 1639. In the seventeenth century, independent workshops included Johann Kaul (Heiligenbeil [Mamonova, Russia], active 1590–1632), Christian Neumann (Wormditt [Orneta], active 1604–19), Johann Werner (Elbing, active 1630–60), Joachim Thiele (Rastenburg [Ke(hk)trzyn], active 1640–53), and David Trampp (Tilsit [Sovjetsk, Russia], later Königsberg; active 1660–98). Thiele's organ in Angerburg (Wegorzewo, 1643) survives in part, but Werner's splendid Bartenstein organ has not (1653; 2/37; destr. 1945).

In 1665, an organ workshop was established in Mohrungen (Morag), Matthias Obuch took it over after 1690. His son, Christoph Heinrich Obuch (b. 1713; d. 1787), continued this workshop until his death. Obuch built the organ for Mohrungen, Stadtkirche (case survives) and village churches in the regions of the East Prussian "Oberland" and the West Prussian "Marienburger Werder"; all were either destroyed or later rebuilt. The first half of the eighteenth century in East Prussia was dominated by Johann Josua Mosengel. Mosengel, the "East Prussian Schnitger" and privileged organ builder to the Königsberg court, is known to have built thirty-seven new organs and rebuilt twenty-two others; of these, only part of the organ case in Heiligelinde (Swieta Lipka; 1729) remains.

Mosengel's son-in-law, Georg Siegmund Caspari (grandson of Georg Adam Caspari I, the brother of Eugenio Casparini), who built the organs in the Königsberg Schlosskirche (1731) and Burgkirche (1734), continued the workshop in Königsberg after Mosengel died. When Georg Sigismund died in 1741, his cousin Adam Gottlob Caspari (grandson of Eugenio Casparini) took over the workshop. After a short period working with his father (Glogau [Gl(sl)ógow], 1740), he was appointed court organbuilder in Königsberg. In East Prussia and Lithuania he built forty-three organs, including several in Königsberg and Vilnius (Church of the Holy Spirit, 1776) and numerous smaller organs in Zinten (Kornevo, Russia), Alt Pillau (Baltiysk, Russia), Neukirch/Tilsit), Gumbinnen (Gussev, Russia), and Germau (Russia). Original contracts, photographs of organ facades, and instruments in Mühlhausen/Preussisch Holland (Mlynary) (1742), Leunenburg (Satoczno, 1745), and Barten (Barcino; 1750) are extant.

Two Casparini pupils became important East Prussian builders. Christoph Wilhelm Braveleit (1752–1795) was active in Königsberg (Sackheimer Kirche, 1790; Propsteikirche, 1792; Tragheimer Kirche, 1794). All instruments were rebuilt; photographs of the facades and original contracts exist. Another pupil, Johann Preuss (1722–1790), became his teacher's competitor. Preuss built at least thirty instruments, including those at Insterburg (1766) and Königsberg-Löbenicht (1782); the grandiose front cases of the latter survived until 1945. Contracts, among them eight for new organs, facade photographs, and the partly preserved organ in the castle chapel in Heilsberg (Lidzbark Warminski) testify to his work. His son Jacob Preuss continued the workshop on a more modest level until around 1830. In 1796 he finished an organ begun by Braveleit in the

Protestant city church in Heiligenbeil; this instrument survived without major changes until a 1929 rebuild.

In West Prussia, the Nitrowski (Nitrofsky) family was busy with rebuilding and enlarging organs in Danzig in the latter half of the seventeenth century. In 1650, Georgius Nitrowski constructed new pedal towers for the organ in St. Catherine's (Hans Helwig, 1607; 3/33). Helwig's work survives in the large organ cases of St. Mary's (1609) and St. Jacob's (1611). In the first half of the eighteenth century, Andreas Hildebrandt headed an important workshop in Danzig. At least nineteen new organs have been documented; many others are attributed to him. His organ for Danzig, St. Barbara (1747; 2/39) was dismantled in 1944 for protection. The partly preserved organ in Praust (Pruszcsz Gdanski) is a typical Hildebrandt one-manual instrument with large pedal towers built into the parapet of the gallery.

About 1756, Hildebrandt's most famous pupil, Friedrich Rudolf Dalitz (1721–1806), took over his master's workshop. The Dalitz organ at Danzig, Corpus Christi (1767; 2/34) survived unaltered; dismantled in 1943 to prevent war damage, it was pillaged where it was hidden. The Rococo case has now been reerected. Dalitz later finished the large organ in Oliva/Danzig (Gdansk-Oliva), Cistercian monastery (1791–93; 3/83) begun by Johann Wulff (1735–1807). Today this instrument still contains about 50 percent of its original pipes. Wulff's father had run an organ workshop in Wormditt until his death (1751).

In the second half of the nineteenth century, organ building in East and West Prussia was dominated by the brothers August and Max TERLETZKI. In 1871, Max, a pupil of Aristide CAVAILLÉ-COLL, left the Ebling workshop owned by the two brothers in 1857 to found his own company in Königsberg. The Terletzki brothers built organs with mechanical tracker action and slider-chests as well as cone-chests, and added a BARKER LEVER action to larger instruments. The organs in Glottau (Glotowo), Allenstein (Olsztyn), and Marienburg (3/30) attest to their work. Other nineteenth-century East Prussian builders were Carl August Buchholz in Berlin (Pelplin Cathedral, 1845; extant), Friedrich LADEGAST in Weissenfels (Memel, Lithuania, 1854), and Wilhelm SAUER in Frankfurt an-der-Oder (Marienwerder Cathedral, 1864). Nineteenth-century Danzig workshops include the Schuricht family and Julius Witt, who built one of the last tracker action organs for the Protestant church in Schönberg, near Karthaus (Szymbark/Kartuzy; 1887; survives in part).

Pneumatic instruments first appeared in East Prussia in Danzig, St. Peter and Paul's; Eduard Wittek (1857–1927) developed a pneumatic box-chest (*Kastenlade*) (1890; 3/41; destr. 1945); Wittek took over August Terletzki's Elbing workshop in 1893; his son Gerhard managed the firm from 1927 to 1944. With the change to pneumatic cone-chests in about 1900, the new organs replaced most of the Baroque organs. Only the cases with the old front pipes were retained, mostly because they were protected by law. Many Wittek organs located in West Prussia (Pomorze-Kaszuby) are still in playing condition. In the southern area of East Prussia (Poland), there remain a number of pneumatic organs of great tonal interest built by Bruno Goebel, who had taken over Max Terletzki's workshop in Königsberg in 1903; his sons Alfons and Friedrich Goebel continued the company until 1944. In 1920, Goebel's third son, Josef, founded his own workshop in the newly founded Free City of Danzig (1920); he built mainly electro-pneumatic organs until 1944. The KEMPER firm of Lübeck, with a workshop in Bartenstein (1931–44), built, rebuilt, and restored instruments, such as the 1653 Werner organ in Bartenstein, Stadtkirche, and the 1726 Mosengel organ in Pobethen. These restorations do not meet today's criteria in every respect but were preferable to the total dismantling typical of other builders

World War II ended a prolific tradition of organ building. In the northern part of East Prussia, now Russian, almost all organs were destroyed. After the dissolution of the USSR, the reconstruction of some churches and their organs came under consideration. The condition of organs preserved in the southern—Polish—part is poor. In 1943–44, the case with the front pipes of the Great and the Rückpositiv of Danzig, St. John's (Matthäus Brandtner, 1685) was dismantled for safekeeping; after the war, the organ was salvaged, reconstructed, and installed in the city's St. Mary's (J. Mollin, 1983; 1/16). As a replacement, St. John's received a new organ by Gebr. Hillebrand, Altwarmbüchen/Hannover (1982–83; 3/46), based on a 1625–29 Merten Friese.

JAN JANCA

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EBERT, JÖRG (D. BEFORE 1582)

German organbuilder. Details of his early life are unknown, but in 1531, as a citizen of Rothenburg ob der Tauber (Bavaria), he received permission from the mayor and city council to pursue his profession in other areas for a time. He received citizenship in Ravensburg (1542); he appears on tax and hospital payment records until 1578. He worked for several important churches and acquired a good reputation, but his delivery of instruments was not always prompt. He received the contract to build the famous organ for the Innsbruck Court Chapel in May 1555, but by March 1557 had not yet begun work on the instrument. The organ's keyboard bears the inscription of 1558, but the work continued another three years.

Among the instruments he built were: Lucerne, Stiftskirche St. Leodegar im Hof (1534), Freiburg im Breisgau, Cathedral (1545; 2/16), Überlingen, Cathedral (contracted 1548), Ravensburg (before 1554), Weissenau Monastery (before 1554), Ottobeuren, Benedictine Abbey (1554–57), and Innsbruck, Hofkirche (1557–61; 2/15).

Surviving organ specifications (Freiburg, Überlingen, and Innsbruck) indicate Ebert used the stops typical of southwestern German organs of the period, including the HINTERSATZ; the Hörndl (sometimes in more than one division); the Faberton (likely a 2-2/3' with 2'); and the Trompete in the Great. The Innsbruck organ had a divided Regal stop (split between the central e/f) on a separate windchest, a kind of Brustwerk. The Freiburg instrument was the only one with an independent Pedal (16' foundation), and it included a Vogelsang and Hertrumen. The common manual compass of Ebert's organs was F, G, A–g'', a''; the Rückpositiv was built on a 4' stop.

DOUGLAS E. BUSH

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ECHEVARRÍA (EIZAGA Y ECHEVARRÍA)

Spanish family of organbuilders of Basque origin, active in the seventeenth and eighteenth centuries. This relatively common surname has led to considerable confusion; there are at least two families of builders named Echevarría. Other builders named Echevarría were active in the eighteenth century (their full names are unknown). Pedro de Echevarría was active in the first half of the seventeenth century; he is known to have worked on the organs in Léon Cathedral (1644). Another family member involved in organ building was the monk José Eizaga de Echevarría (fl. 1659–65).

José de Echevarría I (b. Eibar, Guipúzcoa; d. Palencia, 10 May 1691). A Franciscan in Bilbao, nothing is known about his training. His earliest known activity is the repair of the organ in Tolosa, Santa María (1652). From 1659 on he worked in Alcalá de Henares near Madrid, thereafter in northern Spain. Nothing is known about possible connections to Aragonese organbuilders (such as José Sesma) or the Apaecechea family of Navarra.

José de Echevarría's work heralded a decisive turning point in the form and structure of the Iberian organ. Most of his instruments had a single manual with DIVIDED STOPS, the division coming between c' and c-sharp'. The development of new technical (and thus tonal) possibilities, combined with his expertise in designing and building organs, made him a central figure in the development of the Spanish organ. He was among the first to include the *caja de ecos*, or ECHO chest, which operated on the principle of raising (opening) or lowering (closing) the lid of the compartment, creating immediate dynamic change. (This likely originated with the creation of a separate windchest for the Corneta, allowing its use as a solo stop.)

A second innovation was the introduction of EN CHAMADE REEDS in the facade (*trompetería de artillería*) of the organ at San Diego, Alcalá de Henares (1659), characteristic of the Iberian organ after ca. 1670. In turn, the SWELL and the horizontal reeds inspired the creation of additional reed stops with different timbres. He finally added a short Pedal (with 16' Contras), unusual in organs of his region. He also implemented the use of double (split) keys, distinguishing between the SUBSEMITONES g♯/a♭ and d♯/e♭ in all octaves. In the following century, Antonio Soler, in his *Theórica y práctica del temple para los órganos y claves*, referred to Echevarría's organ at Alcalá de Henares, S. Diego, with a keyboard compass of fifty-eight notes "for the perfection of music"; that is, it could accompany violins and voices with better intonation, because of the double keys.

Echevarría's other instruments include: Eibar/Guipúzcoa; Bilbao, Santiago Apóstol (1660–62, with Ventura Echevarría); Vitoria, Franciscan monastery (1665); Eibar, Santuario de Arrate (1667); Los Arcos/Navarra, Santa María (1665); Mondragón/Guipúzcoa, San Juan Bautista (1677); Villaro/Biscaya, San Francisco (1682); and Palencia Cathedral (before 1682); he died during the construction of a second organ there with Antonio de Echevarría, begun in 1688.

His influence in organ building and design was extensive, important in the "golden age" of the Spanish organ in the seventeenth century. He often delegated the realization or completion of his designs to younger builders, such as his nephew José de Echevarría II, who worked with him in Mondragón. Other builders of his "school" included Domingo de Aguirre (d. 1725) and Juan de Andueza (teacher of Domingo Mendoza).

José de Echevarría II worked with his uncle in Mondragón in 1677 and built organs at Tolosa (1686). He is probably the José de Echevarría who built the organ for Burgos Cathedral (1704–6); he was invited to build a second organ for the cathedral in 1708, but declined on grounds of age. Pedro de Liborna Echevarría built organs at San Lorenzo de El Escorial (destr. 1671), San Lorenzo Mártir in Abades, Segovia (1698) and at Cuenca Cathedral (before 1699). He has been identified with Domingo de Echevarría, who built organs in the Toledo cathedral in 1699.

Pedro Manuel Liborna de Echevarría built an organ for the monastery of the Comendadoras de Santiago, Madrid (1725), worked on the cathedral organ in at Salamanca, Catedral Nueva (1744), Santa Marina la Real, León (1749), and an instrument in Segovia (1769) with José de Echevarría III, described as an "organmaker for the king." His nephew Juan Marigómez de Echevarría (d. 1805) built organs and had the title of "organ maker in the royal chapel" of Madrid until his death, when he was succeeded by his brother José Marigómez de Echevarría.

Douglas E. Bush
Richard Kassel

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ECHO

(1) An organ DIVISION, prevalent in the seventeenth and eighteenth centuries, built into a variety of sections of the main chest and comprising softer Flute stops to achieve the required effect. The Echo was especially popular in France; builders such as Henry WILLIS, Hilborne L. ROOSEVELT, and Ernest M. SKINNER valued the division and included it in a few larger instruments. There was sometimes a separate keyboard for the Echo, but it often shared space with other manuals. It was not designed to fulfill the Baroque tendency toward block dynamics, but as a tonal source in its own right.

In a remarkably literal reinterpretation of the Echo's function, the Passau Cathedral organ, the world's largest organ outside the United States (Eisenbarth, 1978–81, after Steinmeyer, 1928; in 1733 Götz case), comprises five separate organs, totaling 233 stops on fourteen manuals and three pedalboards, spread thoughout the church. The electric action allows access to the Echo Organ via the Main Organ (west gallery) or the Choir Organ (eastern apse). The Echo itself is located in the central vault nave (above the congregation) with its sound emerging from the so-called Holy Ghost opening; it has no manual of its own.

The Baroque Echo chest was sometimes enclosed to heighten the effect. This led to making one side of the enclosure movable to create tonal variants and, later, gradual dynamic changes. Thus the SWELL division evolved in the middle Baroque in part from the enclosed Echo. In twentieth- and twenty-first-century pipe organ design, the Echo has become a low priority.

(2) A modifier applied to stops that have been made softer through changes in their pipes' scaling or other dimensions. Used by itself, Echo may refer to a Flute or Cornet stop; as part of a stop name, it can precede true organ as well as imitative (orchestral) stop names.

See also **Stop**

Richard Kassel

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EGEDACHER

Organ-building family active in Munich, Passau, and Straubing, Germany (GE), and in Salzburg and Wels, Austria (AU). Its members' activity spanned four generations. Christoph Egedacher I (d. before 1662) lived in Straubing, but apparently was not born there, nor did he die there. He may be the same person as Christoph

Eygendacker, who built a positive for the Pfarrkirche in Andernach. He bought a house in Straubing in 1644; his wife is described as a widow in city records of 1662. He built instruments in Schlägl (AU), monastery (1640; positive); Velden bei Landshut (GE), Pfarrkirche (1641); Landshut (GE), Jesuitenkirche (1642); Erding (GE), Stadtpfarrkirche (1643); Lambach (AU), Benedictine monastery (1653–57; 2/20); and Augsburg (GE), Kirche Heilig-Kreuz, rood screen (ca. 1660). His instruments have been lost or radically altered.

His son (Joseph) Christoph Egedacher II (b. Straubing, 19 May 1641; d. Salzburg, 6 April 1706) made a positive for the Munich Court in 1662. He married and was granted citizenship in Munich (1663). From around 1671 on he was active in Salzburg and was appointed organ maker for the court in 1673. He established a very successful workshop, building some forty instruments, and received numerous contracts. He cultivated the emphasis on Principal stops in the Hauptwerk; stops in the Pedal division were often limited to Subbass 16' and (sometimes) Octav 8'. His organs were famous for their engaging sound and the efficiency of their specifications, whereby with only a few stops one could achieve optimal tonal possibilities for liturgical needs. Other instruments were Regensburg (GE), St. Emmeran (1669); Benediktbeuren (GE), St. Benedikt (1682–86); and Salzburg, Theatinerkirche (now Kajetanerkirche, 1696; positive; rest. Rieger). When he rebuilt the organ for Salzburg Cathedral (1703–06; 2/24; case incorp. Metzler organ, 1984), his sons Johann Christoph and Johann Ignaz and six other colleagues assisted him.

Johann Christoph Egedacher (b. Munich, 3 Jan 1666; d. Salzburg, 13 Sept 1747) apprenticed with his father, (Joseph) Christoph Egedacher II. He developed the stylistic principles of the high Baroque with larger specifications that included character and reed stops. In conjunction with the expansion of the Salzburg Cathedral organ, he went to Trento in 1703 to study the S. Maria Maggiore organ by Eugenio Casparini, with its fine synthesis of Italian and South German organ styles, new stops, and combinations; he also studied the construction of reed stops (then rare in Austrian organs). Working with his brother Johann Ignaz Egedacher (b. Salzburg, ca. 1675, d. Passau, 20 June 1744), Johann Christoph helped enlarge the Salzburg Cathedral organ (1703–6; 3/42). Character and reed (*unterscheidliche*) stops were the main additions, there being no reeds in the original organ. The new stops were modeled after the Casparini in Trento: Hobona, Flauten, Flaschalett, Sordunen, Rankhett, Harpfen (a reed stop), Scarpen (a reed), Posaune, Cornet, Biffara, Rauschwerk VIII, Hörerbauckhen (Pauke or drum), and Vogelsang.

In 1716 Johann Christoph visited Andreas SILBERMANN in Strasbourg; they had met while the former was working in southern Germany. He studied Silbermann's approach to building reed stops; from then on, Silbermann's influence is apparent in the specifications and sounds of Johann Christoph's organs. In 1718 the Salzburg cathedral organ was again refurbished and expanded to forty-three stops. Other instruments include: Salzburg, positive (ca. 1700; now in Museum Carolino Augusteum); Salzburg, Universitätskirche (1708–09; 2/24); Mattsee (AU), Stiftskirche (1711); Salem (GE), Cistercian Abbey (1716–20; four instruments); Prien am Chiemsee (GE), Pfarrkirche (1738–39); Herrenchiemsee (GE), Cathedral (ca. 1740), and Linz, Karmelitenkirche (1741).

Johann Ignaz Egedacher was known as the "Passau Egedacher." He apprenticed with his father and moved to Passau, where in 1709 he married the daughter of organbuilder Leopold Freundt (b. ca. 1640; d. 1722; Passau, Cathedral, 1688, 2/23). After the death of his father-in-law, Johann Ignaz took over the workshop (1727). In 1745, his daughter married the organbuilder Philipp Jakob Schmidt, an apprentice to Egedacher who assumed leadership of the workshop, now vacated.

Johann Ignaz, the most successful of the family, built some thirty organs and worked in the areas of the Danube from lower Bavaria to Lower Austria. Next to the Principals he often incorporated wide-scaled stops (especially flutes) and strings into his instruments. With the emerging of new musical styles, he abandoned the use of the broken- or short-octave keyboards. His cases are particularly beautiful, and he used a characteristic *V*-shape in the layout of the facade pipe fields. His Austrian instruments include: Kallham, 1715 (rest. Riedl and Pössl, 1976); Neufelden, ca. 1728 (reconstr. Edskes, 1997); Zwettl, Cistercian monastery, 1728–32 (3/36; rest. Hradetzky, 1983); and Hartkirchen, 1736 (rest. Rieger, 1978). However, his relocation to Passau in the late 1720s has focused attention on his German works, including Passau, St. Stephen's Cathedral, choir organ, 1715–18; Passau, St. Nikola, ca. 1730; Passau, St. Stephen's Cathedral, 1731–33 (3/38; incorp. 1928 Steinmeyer organ); Vornbach am Inn, Klosterkirche, 1732 (2/20); Griesbach, St. Salvator, 1735; and Passau, Dom, Lambergkapelle, 1737 (rest. Eisenbarth 1954).

Two other sons of (Joseph) Christoph Egedacher II were involved to a lesser degree in the family business. Johann Franz Xaver Egedacher (1678–1751) studied organ building with his father, but then turned to military service; Johann Joseph Egedacher (1668–1717) worked as a colleague in the Salzburg workshop.

Three sons of Johann Christoph Egedacher also became involved in organ building. Johann Christoph (II) Egedacher (b. Salzburg, 22 Oct 1706; d. 1756), known as Hans or Johann, was only briefly active in his father's workshop. In 1740 he settled in Wels, Austria. No known works of his survive. Johann Georg Cajetan Egedacher (b. Salzburg, 1711; d. there, 1770) helped in the family business, but then studied theology and became a pastor. Johann Rochus Egedacher (b. Salzburg, 5 Aug 1714, d. there, 14 June 1785), like his brothers, was not initially interested in organ building; in 1728 Johann Christoph (I) asked Andreas Silbermann if one of the latter's sons might come to Salzburg and eventually take over the business. But Johann Rochus changed his mind, and went to Passau to apprentice with his father. In 1747 he took over direction of the Salzburg workshop and became court organbuilder, as his father and grandfather had been. He was also known as a fine organist. At first his organ-building business was very good, but the situation deteriorated, thanks in large part to the declining interest in organ playing and building new instruments. He then turned to building fortepianos but, according to Leopold Mozart, these were not of very good quality because of insufficiently aged woods.

A hallmark of Johann Rochus's organs is the inclusion of characteristic color stops such as Viola, Quintadena, Nazard, Waldflöte, Trombon, Dulciana, Blockflöte, and Gambabass. About twenty-five new and rebuilt organs are known, among them: Brixen (Italy), Pfarrkirche St. Michael (1740; 2/24); Salzburg, positive (1750; now in Museum Carolino Augusteum); Salzburg Cathedral (1753; added four stops); Maria Pfarr (AU) (1757); Lungau (AU), St. Michael (1759); Salzburg, St. Michael (1770; Brüstungspositiv; rest.), Zell am Ziller (AU) (1777); Titmonning (GE) (1779); and Radstatt (AU) (1785). He was also active in the greater Salzburg region (Uttendorf, Thalgau; Berndorf, Seekirchen, Radstadt), the Tirol (Brixen im Thale, Bruneck, Zell am Ziller) and Styria (St. Veit am Vogau). He was well known for restoring the 1502 "Salzburger Stier" (1735), the oldest working giant musical clockworks in the world. He built at least one organ in Upper Bavaria (Tittmoning, 1779). His son, Rochus Franz Ignaz Egedacher (b. Salzburg, 1749), was a theology student, but occasionally helped his ailing father with his work. In 1785 the Egedacher workshop in Salzburg was taken over by an apprentice, Johann Evangelist Schmidt, who also became court organbuilder (1786–1803); the Egedacher organ-building dynasty had come to its end.

The Egedachers influenced several of their contemporaries in Austria and in southern Germany; they are sometimes credited with having established a "Salzburg school." They were also instrumental in introducing the freestanding console in Austria. The end of the Egedacher dynasty coincided with the secularization activities of Holy Roman Emperor Joseph II, who dissolved many monasteries.

Maximilian Zweimüller

Translated by Douglas E. Bush

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EIGHT FOOT

In present organ terminology, the register associated with normal or unison pitch, specifically the octave based on c' = 256Hz, as distinct from FOUR FOOT (octave higher) or SIXTEEN FOOT (octave lower). Historically this is an approximation only, depending on length of foot, standard pitch, wind presssure, and type of pipe, scale, and flue size. Before measurement became standardized (seventeenth century), systems based on now obscure or undetermined lengths were used. The 8' rank is the heart of the HAUPTWERK, appearing more often than any other octave in postmedieval organ-building history; they are usually the plurality in other divisions, with the exception of the Pedal, Rückpositiv, and those in smaller organs.

See also **Stop**

Richard Kassel

ELECTRIC

See Relay and Switch Systems

ELECTRIC ACTION

See Action

ELECTRONIC ORGAN

The electronic organ, first developed at the start of the twentieth century, mimics the timbres of a pipe or reed organ (harmonium) by means of electric or electronic sound synthesis, and is audible only over a loudspeaker system.

Introduction

The essential features of all organs, whatever their name, whether electronic or not, or whether intended as a substitute for a pipe or reed organ, are: the ability to sustain notes at a constant loudness while keys are depressed; the facility for continuously increasing or decreasing the loudness of sustained sounds (the swell box in Baroque and later pipe organs); some degree of polyphonic capability that enables both chords and independent parts to be executed (electronic instruments in early stages of development were often monophonic); and a variety of possible timbres.

The cost and size of such instruments are less than for an equivalent pipe or reed organ. More than two million instruments were sold by a leading manufacturer, Hammond, in its first fifty years. The electronic circuits and other mechanisms are normally contained inside the performing console; in some early instruments an additional electronics cabinet is linked to the console with an umbilical cable. Maintenance is comparatively cheap and rapid, involving far fewer moving parts, and regular tuning is normally unnecessary.

From the mid-1970s on, the electronic organ increasingly began to share its features with the newly introduced polyphonic synthesizer, and today most organlike instruments, apart from church models, are marketed as "electronic keyboards" or "digital keyboards." Because a significant proportion of even the earliest instruments still survive, they are described here, where appropriate, in the present rather than the past tense. Since most electronic organs are intended to be played in an identical manner to their acoustic equivalent, this article will only emphasize unconventional features that performers must familiarize themselves with; a pedalboard (normally full-size) is assumed with those instruments intended for public performance, while a reduced pedalboard is associated with larger domestic instruments.

In performances of classical concert music the role of the electronic organ has primarily been to replace a pipe organ in standard—often choral—repertoire in halls that lack such an instrument or with a pipe organ in repair or rebuild (sometimes for weeks or months). It is also the most appropriate domestic practice instrument for concert organists who have no links with a local church. Some contemporary composers have felt that its qualities are particularly appropriate for their personal sound worlds.

The principal musical fields in which the electronic organ quickly found a significant role were in church music, jazz and vernacular (popular) music, light entertainment, and domestic usage. Models intended for churches had to imitate the sonic features of a pipe organ as accurately as possible; the instrument's success in this field is partly due to its providing of an intermediate choice between the pipe organ and the reed organ. In jazz and popular music, specific sonic ingredients and performance techniques on the electronic organ directly contributed to the development of different styles; in the mid-1930s, for example, the introduction of the Hammond organ, one of the first comparatively portable polyphonic keyboard instruments capable of sustained sounds, matched the new jazz sounds of swing. Electronic organs designed for light entertainment also brought portability to the THEATER ORGAN. "Home organs" supplied much greater tonal variety in a domestic context than a piano or reed organ, and have also appealed to those who wished to construct their own instrument (often from available kits).

The attractions of a custom-built electronic organ over a musically comparable pipe organ include savings on cost, physical space, and maintenance, and choices of two or more voicings (such as Baroque and classical, Romantic and traditional, English and Continental) and temperaments (typically equal, meantone, and Werckmeister III). In most recent instruments the timbres have been "sampled" (digitally recorded) from existing pipe organs, or resynthesized from samples. (This technology was anticipated by electromechanical oscillators during the 1930s, in what can retrospectively be described as "analog sampling"; examples included the photoelectric Lichtton-Orgel and the electrostatic Compton Electrone, both of which featured waveforms derived from well-known pipe organs.)

Since the 1980s, with the advent of digital circuitry and increasingly affordable computer memory, originally providing electronic sounds with sampled attacks, digital sampling has largely ousted all other methods of sound generation. With each stop, each note can be individually tuned, as with a pipe or reed organ; a wide choice of reverberation qualities can enhance the overall sound. Digital instruments can have

MIDI (musical instrument digital interface) capability, which also enables performances to be digitally recorded and replayed.

The fidelity of the electronic organ in re-creating the sound of pipes has been in question since the introduction of the Hammond organ in 1935. The two lengthiest disputes, both instigated by pipe organ–builders, challenged the right of two manufacturers to use the name "organ" for their product: (1) Hammond, in hearings conducted by the U.S. Federal Trade Commission in 1936–38, during which a panel of experts in a blind test failed to detect the difference between a Hammond and a pipe organ in one-third of the examples; and (2) Ahlborn, sued by the Bund Deutscher Orgelbaumeister (1959–69), during which a book of essays was published in 1964 in support of the alternative term *Elektrium*. Both manufacturers eventually won.

The Second Vatican Council of the Roman Catholic Church in the 1960s emphasized the preeminence of the pipe organ in sacred music, but stated that other instruments could be used "with the knowledge and consent of the competent territorial authority, provided that the instruments are suitable for sacred use." Intended as an (ultimately unsuccessful) warning against adopting guitars and other instruments into the liturgy, the ruling effectively legitimized the previously rejected electronic organ.

Sound Generation

Three different basic methods of sound generation have been explored in electronic instruments; they are described below in order of complexity, starting with the simplest application of electricity. Each type makes use of oscillation, in which moving mechanical elements or oscillating electronic circuits produce regularly fluctuating electric currents, made audible in a loudspeaker. The most appropriate overall term that encompasses these three methods is "electronic organ"; in everyday use, no distinction is made between this term and "electric organ," even though the latter is an inappropriate description of any instrument that employs fully electronic oscillators. (Up to around 1930 the term *electric organ* was sometimes applied to pipe or reed organs in which electric or electro-pneumatic action replaced tracker action.)

The first method is electroacoustic or electric sound generation, whereby a conventionally vibrating reed (the most common source), string, plate, rod, bell, tuning fork, or organ pipe forms part of an electronic circuit or is amplified via some form of microphone, transducer or pickup. These sound sources are normally enclosed or deprived of a resonator such as a soundboard so that they are not acoustically audible at a distance. The vibrations of reeds are sometimes maintained electrically. Electric organs were primarily manufactured between the early 1930s and the 1960s, with antecedents in the 1880s. The principal electric instrument still in use today is the guitar.

The second method is electromechanical sound generation, in which moving parts—usually one or more sets of parallel-mounted, rotating disc-shaped "tone-wheels," on which regularly varying waveform-like patterns are profiled either individually on the rim of each disc or in concentric rings across their surfaces—pass close to electromagnetic, electrostatic, or photoelectric sensors, creating an oscillating current. The expense of constructing and maintaining such precision mechanisms, especially as increasingly cheaper and more reliable electronic circuitry evolved, meant that such instruments were not manufactured after the early 1980s. The diameter of tone-wheels has ranged from the 46 cm multibanded cylinders of the electromagnetic Telharmonium at the beginning of the twentieth century to the 4.7 cm discs of its virtual offspring, the Hammond organ.

The third method is electronic sound generation, in the form of oscillator circuits based entirely on electronic components, initially using vacuum tubes, later on transistors and, most recently, integrated circuits (computer chips); there are no moving parts. The last of the three methods to be explored, this is the primary one in use today, even when samples of acoustic sound sources are used. The vacuum tube, invented in 1906–7, did not become commercially available until 1920; the first oscillator-based electronic organs soon followed. Tubes remained comparatively unreliable until after World War II; during the early 1930s, for example, the failure of a single tube on the largest electronic organs (many with more than 250 tubes) could wreak havoc on public performances; a technician was stationed at the rear of the console or electronics cabinet to replace any tube that failed.

Most electronic organs feature a single set of oscillators, one for each note on the keyboard; different timbres are obtained by additional circuitry, mostly in the form of filters rather than extra sets of oscillators. With fully electronic oscillators a variety of methods have been used to create this single set, and, unlike pipe organs, no simple correlation exists between the number of keys on the manual(s) and the number of basic circuits. The most expensive models of electronic organ normally have more circuits than keys, the cheaper models fewer circuits.

Beginning in the 1940s, midprice and cheaper models featured a reduced complement of oscillators, most commonly with twelve circuits that generated a single chromatic octave at the top of the required pitch range (or one octave higher), then deriving each lower octave by means of sets of simple frequency dividers. This approach evolved in the 1970s into a single very high frequency oscillator with two sets of frequency dividers, the first of which created the high-pitched chromatic octave; this principle has been applied in many digital organs. Further reductions were achieved in some cheaper models by the use of "shared" oscillators, in which only one out of two (in a few cases, three) adjacent keys could control each oscillator, limiting simultaneous sounding of adjacent pitches (much like the fretted clavichord). The main drawback to any form of frequency division is that all divided octaves from a single oscillator are perfectly in tune and in phase with each other, producing an effect never heard with acoustic sources; appropriate "imperfections" are now introduced. Another method of fattening the sound, borrowed from pipe organ techniques (equivalent to the Piffaro and Unda Maris stops), is the "chorus generator," introduced around 1937 for the Hammond organ, which adds slightly detuned pitches to create beat frequencies.

During the 1970s, with the growing influence of digital circuitry, a variety of features became widespread on commercial electronic organs (apart from church models): different chord systems (such as accordion-like chord buttons, introduced by Hammond, ca. 1952), rhythm units (1960s), "walking" bass units, and built-in cassette recorders (1970s); all were superseded in the 1980s by their digital equivalents, arpeggiators and memory storage, except for the unique LOWREY downward semitone glissando (from 1956 on). The digital era brought further refinements such as transposition, a wide selection of reverberation simulations, and mimicking the touch of the keyboard of a tracker action pipe organ.

As with acoustic keyboard instruments, hybrid instruments involving electronic organ elements have been explored. During the 1930s electronic bass sections were added to some smaller pipe organs to provide 16' and 32' stops; the Allen Organ Company continued this practice into at least the 1950s. Electronic solo voices were also added in the 1930s, especially to theater organs. More equally balanced hybrids were built subsequently by Ahlborn, Allen, KILGEN, Lipp, and especially Rodgers (over 3300 instruments since 1972), while around 1980 Conn introduced registers in which electronic sounds are fed via small loudspeakers through tuned pipes. Enclosed sets of pipes amplified by microphones were featured in several organs between 1934 and the 1950s. In the 1970s most WURLITZER electronic organs featured an additional two-octave, primarily monophonic synthesizer manual.

Sound Diffusion

Essential to an electronic organ is the amplification system that makes its sounds audible. The first electric loudspeakers were based on the earpiece of the telephone, invented by Alexander Graham Bell in 1875–76. Such loudspeakers responded to fluctuations in electric current caused by a vibrating electromagnetic source—in the case of the earliest electronic instruments, a rotating electromechanical tone-wheel or an acoustic source such as a free reed or a piano string. The resulting sounds were never very loud, even when reinforced by a conical cardboard or metal diffusion horn and however powerfully the earpiece was driven. The degree of amplification necessary for the further development of electronic instruments only became possible with the introduction of the vacuum tube amplifier in the early 1920s.

A major difference between acoustic and electronic organs is the directional aspect of the sound, especially with the more location-specific higher notes. In contrast to spatially separated arrays of individual acoustic pipes, the entire complement of electronic sounds can by transmitted by a single loudspeaker. Multiple loudspeakers are one solution to reducing this discrepancy; for greater contrast, separate loudspeakers are sometimes given different frequency characteristics, either with electric filters (similar to "tone controls" on a high-fidelity amplifier), or by unconventional loudspeaker designs. A more grandiose approach is the use of large quantities of smaller, widely dispersed loudspeakers, occasionally in nonpermanent multispeaker installations; examples are: Virgil Fox, touring with a three-manual Rodgers organ (1966) featuring 134 loudspeakers in thirteen cabinets, replaced in 1975 by a five-manual model; Carlo Curley, with a four-manual touring Allen organ (1976) with 380 loudspeakers (fifty cabinets); and Fox's switch to a similar Allen organ (1977) with around 600 loudspeakers.

The same potential for channeling all the electronic sounds through a single loudspeaker has permitted a simpler approach in the two basic methods for creating tremolo and vibrato effects: the sound can be modulated by means of a low-frequency electronic or electromechanical oscillator, or an equivalent mechanical vibration can be applied either to the actual loudspeaker by rotating it (as in some models of the "Leslie" loudspeaker) or placed directly in front of it, in the form of a rotating paddle—a principle explored in reed organs as early as the 1860s.

The timbral complexity of the pipe organ is inevitably difficult to imitate; earlier designers simulated the functioning of pipes by incorporating "chiff" attacks for Flute stops and delaying the sounding of lower-frequency pitches by a few microseconds. In recent years increasingly sophisticated digital technology has enabled designers to build in small-scale irregularities to the release of a sound, in line with what occurs in acoustic sound sources (particularly the interaction between the individual sources), and to the body of a sustained sound, to achieve a better blend of the notes played and a more accurate recreation of different acoustic spaces.

The Instruments

In less than a century and a quarter, the electric organ and its successors have developed at a pace that would stun even the technology-savvy builders of the nineteenth century. The earliest electric instruments capable of sustained sounds were devised and often patented in several countries in the mid-1880s; most of them employed electromagnets to activate piano or other strings and maintain their vibration. Patents for electric action in organs had been granted from the early 1850s; electrically activated instruments were built in France in the late 1860s by Charles S. BARKER, but this approach did not become widespread until the 1880s. The first two instruments that resembled the pipe organ more closely, even in size, were independently developed, primarily in Massachusetts, in the 1890s and early 1900s. Both of them were based on electromagnetic tone-wheels. Like the pipe organ, which requires substantial concealed mechanisms and wind supplies, these included machine-rooms for the sound-generating equipment and power supplies.

The inventor of the better-known instrument, Thaddeus Cahill, was a lawyer who had patented various improvements in piano action and electric typewriters. The original prototype of his Telharmonium (Dynamophone), with two conventional manuals (kept by one of Cahill's brothers until shortly before the latter's death in 1962), was followed by a second model (1903–6), with three five-octave special manuals, each with four banks of keys (allowing for the use of just intonation) and a pedalboard. This was installed in Telharmonic Hall in New York in 1906, where for a few months several public performances were given every day, often by two players in duet, in which whereby the operation of timbre switches and a "dynamics manual" were assigned to the second player. The instrument was linked by landlines to telephone loudspeakers in local restaurants, hotels, theaters, and private homes. Long conical cardboard horns increased the loudness (like the Victrola phonograph), but the strength of the landline signals interfered with nearby telephone cables, contributing to the demise of the enterprise. In 1911 a third model was installed at a second location in New York, and was operational for a short time.

Melvin L. Severy's Choralcelo (compl. 1908) was designed for installation in private homes, and less well known than the Telharmonium. Technologically simpler, it involved electromagnetically activated piano strings (some models used metal, wood, and glass objects). It had two manuals (sixty-four and eighty-eight keys) and a thirty-two-note pedalboard. The conventional piano mechanism (with an optional player piano feature) linked only to the lower manual could be combined with or disconnected from the "organ" mechanism, in which a series of tone-wheels drove the separate sets of electromagnets positioned in different positions along the strings to produce a variety of timbres. Performances were given in homes from at least 1918 on, in one case continuing into the 1950s. At least fourteen instruments were sold, and three are known to have survived into the 1980s (an apparently modified Choralcelo is in the Ruthmere House Museum in Elkhart, Indiana).

The development of the electronic organ slowed until the early 1920s, when the vacuum tube became commercial available and was consequently incorporated into the electronic oscillator and electronic amplifier (with appropriate new loudspeaker designs). At least two electromechanical instruments featuring photoelectric tone-wheels were developed, by Johannes Van Der Bijl at Western Electric in New York (1916) and by Charles-Emile Hugoniot in France (1921). Hugoniot was granted a variety of sound-generation patents (1919–22) that, together with Cahill's patents (with which Hugoniot was familiar), strongly influenced the new group of French pioneers. These included the photoelectric Cellulophone (Pierre Toulon, ca. 1927) and the first fully electronic instrument, the Coupleux-Givelet organ (1928–30); two-manual models of the latter were installed in several French and Swiss churches, while a three-manual model (the *orgue des ondes*) arrived at a radio station in Paris in 1932. Other inventions included Abbé Pujet's electroacoustic Orgue Radiosynthétique (1934, with the pipes enclosed in three chambers, each amplified by a microphone and loudspeaker); the Mutatone (1938), an electrostatic reed organ designed by Constant Martin (who after 1945 would design the first Miller organ), and the Tournier organ (Marcel Tournier, 1938).

In Germany, similar exploration was carried out from the late 1920s onward, particularly in Berlin, at the Heinrich-Hertz-Institut für Schwingungsforschung of the Technische Hochschule and at the Rundfunkversuchsstelle of the Staatliche Akademische Hochschule für Musik, where the Trautonium was developed. At the Hertz Institute several significant instruments were created by Oskar Vierling, including the Elektrochord electric piano and two electronic organs, of which the more successful was the "Kraft-durch-Freude-Grosston-Orgel, a three-manual instrument, comparable in size and capability to the largest Coupleux-Givelet organ, employed at the opening ceremony of the 1936 Olympic Games in Berlin. A two-manual photoelectric organ, the Lichtton-Orgel, was developed in Freiburg by the codesigner of the Welte-Mignon player piano, Edwin Welte; its "timbres" consisted of graphic representations of the waveforms of selected stops from major European pipe organs, an early form of analog sampling; three versions were constructed (1934–36). In Austria, Rudolf Stelzhammer constructed the Magneton, an electronic organ based on electromagnetic tone-wheels (1932–33).

Partially polyphonic approaches were devised in Germany during this period, specifically for the performance of contrapuntal music such as Johann Sebastian Bach's organ works, which offered the selection of a separate timbre for each voice. The two models of the Partiturophon (1930–31) built by Jörg Mager (who was assisted by Vierling in its early development) featured three and four monophonic manuals, respectively, with keys of reduced depth—permitting two or even three to be played with a single hand—plus a monophonic pedalboard. Mager had also patented almost a dozen loudspeaker designs that used unconventional resonators based on wood, metal, and thin paper, each producing a different timbre. A special switching system in the four-voice Warbo Formant-Orgel (1937) of Harald BODE enabled a different timbre or attack to be allocated to each of the four highest pitches played on a single manual, anticipating the "assignment" techniques found in many recent synthesizers and electronic keyboards that lack the full complement of one oscillator per note.

In Britain an electrostatic tone-wheel system devised by Leslie Bourn was the basis for the Electrone electronic organs manufactured by the John H. COMPTON firm from 1938 on (by 1940 some 80 instruments existed); in the mid-1930s the company had begun to incorporate a simpler form of this system (under the name Melotone) into hybrid theater organs. A similar instrument, the Midgley-Walker Organ, was marketed from 1939 on by J. W. WALKER and Sons for a short time before war halted production; it was designed by A. H. Midgley, on whose patent Bourn's work had been based.

In this period American inventors explored all available sound-generation techniques. Richard H. Ranger utilized photoelectric tone-wheels in his Rangertone Organ (1931), featuring push-button tremolo and timbre selection for six separate amplifiers and loudspeakers; around 1933 Ranger built a single-manual version for concert use. A Russian-born inventor, Ivan Eremeeff, constructed several electromechanical instruments, including the single-manual Gnome (1932), based on electromagnetic tone-wheels, and two organs involving photoelectric tone-wheels: the two-manual Photona (1933–35) and the single-manual Syntronic Organ (ca. 1934), for which a tone-wheel mechanism inscribed frequency and timbre patterns on its moving lengths of optical film. Eremeeff was championed by Leopold Stokowski, who envisaged an all-electronic keyboard orchestra. In 1934 the first substantial production of electronic organs was initiated with the Everett Piano Company's Orgatron, designed by Frederick Albert Hoschke after a Benjamin F. Miessner patent. The most significant of the true electric organs, the Orgatron featured an electrostatic system in which reeds activated by suction were enclosed in a soundproof chamber. (It would become the basis for Wurlitzer's first electronic organs, in 1946.) Selling mainly to churches in one- and two-manual versions, the Orgatron would have become the major electronic organ of the 1930s if it had not been rapidly eclipsed by a more economic instrument that appeared in 1935.

The Hammond organ, invented by Laurens Hammond (maker of electric clocks) and John M. Hanert, used small rotating electromagnetic discs, one per note. Higher overtones were synthesized by "borrowing" the output from other tone-wheels using "drawbars"; this added tempered, not natural overtones. This divergence from pipe organ sound did not prevent one-third of the earliest instruments being purchased by churches; sales within the first three years reached around five thousand instruments.

Other tone-wheel instruments were developed in the United States during the 1930s, but were either manufactured in very limited quantities or not at all. In Canada, up to twenty of Morse Robb's electromagnetic Wave Organs were sold between 1934 and 1938. From 1939 two fully electronic instruments were marketed in small quantities: Jerome Markowitz's first Allen organ, and the Novachord, a single-manual organlike instrument designed by Hammond and C. N. Williams. The Novachord had sophisticated timbre controls (it was advertised as an "electrical orchestra") and two speeds of vibrato controlled by vibrating reeds. This was probably the first commercial electronic instrument based on the principle of twelve high-frequency oscillators with frequency division.

The music in which the Hammond organ found its real home was the new swing style of jazz. No portable sustaining keyboard instrument had been previously available, let alone one of such expressive range and flexibility, and many players made full use of the pedals. Its first great jazz exponent was Fats Waller (an experienced pipe organ player), whose swirling chords and staccato bursts of sound (in part caused by the inability in early models to control the attack of notes) demonstrated the Hammond's potential for creating a new sound representative of a new music. Other major jazz performers of the Hammond organ followed, such as Jimmy Smith, Jimmy McGriff, Larry Young, and Barbara Dennerlein, mastering the unusual sliding "drawbars" that provide dynamic control over individual overtones. The audible key click, a prominent aspect of the original mechanism, was eliminated in the mid-1970s when the company finally phased out tone-wheel mechanisms—only to be reinstated after many musicians complained.

Developments with electronic organs since 1945 have been rather different, and although more companies than ever became involved, the instruments can be summarized more succinctly because of commercial standardization. By the 1950s and '60s an increasing quantity of manufacturers produced more highly specialized models with more diverse specifications. In some cases existing pipe and reed organ manufacturers branched out into electronic organs and subsequently abandoned the acoustic side. Eventually, solid-state circuitry (based on transistors rather than tubes) allowed for miniaturization, greater reliability, and digital programming.

Since 1945, in alphabetical order by country, important electronic organ manufacturers of all types (including remotely controlled "organ modules" without keyboards) have included: France: Dereux; Germany: Ahlborn, AWB, Böhm, Hohner, Lipp, Tuttivox, Vierling, Wersi; Italy: Bontempi, Crumar, Elka, Farfisa, Gem, Siel, Viscount; Japan: Casio, JVC, Kawai, Korg, Roland, Technics, Yamaha (especially the Electone series); Netherlands: Eminent, Johannus, Philips (the Philicorda); the U.K.: Bradford Computing, Compton (Electrone),Copeman Hart, Jennings (later Vox), Makin, Miller (now Norwich), Selmer, Wyvern; the United States: Allen, BALDWIN, Conn, ESTEY, Gulbransen, Hammond, W. W. KIMBALL, Kinsman, Mastersonic, Minshall, Lowrey (including the Organo module), Rodgers, Schober, Thomas, Voce, Wurlitzer; the USSR: Kristadin, Shumofon (a SOUND EFFECTS keyboard), and Yunost. Home organs were produced in other Eastern European countries. At least a dozen major companies still market electronic organs, primarily for churches.

In the fields of church and concert organs, electronic instruments can mimic their pipe equivalents even more precisely. Three- and four-manual instruments were introduced in the 1950s and 1960s, with greater focus on custom-built models. The most significant innovation has been digital circuitry, initially for sampled timbres (pioneered in 1971 with the Allen Digital Computer Organ), and subsequently for other aspects that could be brought under computer control (some of which have also been applied to pipe organs), including memories for storing preset stop combinations. Electronic forms of theater organs, including special effects, became popular with light music recitalists.

In jazz and popular music, the original Hammond organ has largely remained the yardstick for performers. The growth since the early 1960s of rock music, the other major area of popular music today, was accompanied by a corresponding development of appropriate new features, also found in home organs. Such instruments mostly have one or two manuals, larger models often featuring a single-octave monophonic pedalboard, with one or more loudspeakers incorporated in the console. In 1949 Hammond introduced the influential "spinet" organ, in which two manuals (each with a maximum of four octaves) are offset by one octave. Weight and size have been substantially reduced, from at least 80 kg (1930s), to half that amount for dance band "combo" organs (1950s) to smaller electronic keyboards weighing between 2 and 3 kg, often with narrower keys designed for children (1980s).

Related to the electronic organ is the Mellotron (1964), an "analog sampler"; timbres were recorded on replaceable banks of short lengths of magnetic tape. It rapidly attracted the interest of groups such as the Beatles and the Moody Blues, but was difficult to maintain as a touring instrument. In response to its success, especially with sustained string ensemble backgrounds, the "string synthesizer" or "string ensemble" and the related "polyphonic ensemble" were introduced in the late 1960s, primarily by Italian manufacturers. These concentrated on stops directly related to individual timbral categories, such as strings, brass, organ, and piano, sometimes in combination. After the mid-1980s these were replaced by the more flexible digital synthesizer.

Because of its console and performance requirements, a more specialized type of electronic organ is the electronic accordion. Around 1950 Hohner introduced the accordionlike Electronium, and soon afterward integrated a similar electronic section in hybrid accordionlike instruments such as the Multimonica. Since the early 1960s several Italian companies have marketed conventional electronic accordions.

See also **Action**

HUGH DAVIES

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ELECTRO-PNEUMATIC ACTION

See Action

ELLIOT, THOMAS (1759–1832)

English organbuilder. He is recorded as having worked in different London locations from 1791 on. W. Nutt, whose partner Elliot became (ca. 1803), was previously a partner of Ohrmann, John Snetzler’s foreman and successor (from 1780 on); this has convinced some to treat Elliot and his successors (notably William Hill, who married Elliot’s daughter and helped form Elliot and Hill in 1825) as a continuation of the Snetzler tradition in England.

Elliot exported organs to both Quebec City cathedrals (Roman Catholic and Anglican) in 1802. He also built instruments for Montreal, Christ Church (1816); North Hobart (Tasmania), Uniting Methodist (1824), and Waterford (Ireland), Christ Church Cathedral (1817; rest. K. Jones in orig. double case, 2003). Other instruments survive at Thornage (Norfolk), All Saints, 1812; Perth (Scotland), Scone Palace, 1813; Broome, 1817; Ashridge, 1818; Crick, St. Margaret of Antioch, 1819; and Grantham, Belton House, 1826. Hill’s presence apparently encouraged Elliot to build larger instruments for Oldham (1830) and London, Christ’s Hospital (1830; now at Horsham, with surviving pipework). He contracted to build an organ for York Minster in 1829, but died before its completion, undertaken by Hill (rest. Hill, 1859, etc.; extant).

Elliott was a productive if essentially conservative builder. He pioneered the English use of Pedal pipes (8' and 16', the latter at Derby, All Saints, 1807) and made extensive of a second Open Diapason on the Great manual. Henry Corrie, who went to Boston to install an Elliot instrument at the Old South Church in 1822, remained in the United States. Elliot’s son John built a one-manual organ for Hobart, St. John the Baptist (1864; orig. pipework in enlarged organ; reb. 1969; 2/18).

Richard Kassel

EMS-DOLLART REGION

The most concentrated region of well-preserved historic organs in the world, Ems-Dollart encompasses the present German province of East Frisia (Ostfriesland) and the Dutch provinces of Groningen and Drenthe; thus it bears limited relevance to present political boundaries. Centered around the Dollart Basin and the Ems River, this area, with its shared cultural past, is home to over three hundred historic organs and organ facades, spanning six centuries of organ-building history.

The earliest surviving organ-building documents come from the mid-fifteenth century. The first known organ was built for the church in Marienhafe which, until its partial collapse in the nineteenth century, was the most imposing structure in Ostfriesland. At least ten medieval organs, probably Blockwerk instruments, can be traced to the area known, ironically, as the Krummhörn, located between Norden and Emden. The first named organbuilder in Ems-Dollart was Johan ten Damme of Appingedam, active in the latter fifteenth century. Ten Damme may have built a small instrument in Rysum (1457; rest. to 1513 disposition; extant), as well as a three-manual organ (1481) in the Groningen Martinikerk. Another builder in the late Gothic style, Johannes Emedensis, built the organ in Scheemda/Groningen (1526; case and facade in Rijksmuseum, Amsterdam).

In the early sixteenth century, organ-building style began to take on Renaissance features; the surviving organ in Krewerd (1531) is an outstanding representative of this transitional period. By midcentury, new organ-building influences were flooding in from the west and south as waves of Protestant refugees, fleeing the Spanish campaigns in the LOW COUNTRIES, moved into or through the area. While some newcomers burned organs during the Iconoclast riots, others built them, most notably Andreas de Mare, a major builder from Ghent who relocated to Groningen in the 1550s; except for some pipework retained in later organs, de Mare's instruments no longer survive. However, several smaller Renaissance instruments, ideal for the vocal-influenced polyphony of the time, are still in existence, including Emden-Larrelt (1618–19), Uttum (ca. 1660, with sixteenth-century pipework), and Osteel (1619); the last is the work of Edo Evers who, unlike many builders active in Ems-Dollart, was actually born there (Ostfriesland).

The rapid rise of congregational singing in the seventeenth century made new demands on both organ and organist and led to considerable organ-building activity in the area. Church protocols from the time show this changing emphasis: in 1628 the Emden church council declared the organ "an unnecessary and popish work," but in 1640 decided to experiment, allowing the organ to accompany congregational singing. In Westerhusen/Emden, an organ (1642–43) clearly influenced by congregational needs was built by Jost Sieburg, who may have been a refugee from religious fighting in central Germany. More midcentury organs survive in Groningen province, including Midwolde (1630/ca. 1660), Noordwolde (ca. 1640), and Zeerijp (reconstr. to 1651 state). Two other Groningen instruments, at Kantens (ca. 1660) and 't Zant (1662), were built by Hendrick and/or Johannes Huis, possibly brothers of Berendt HUSS.

Congregational singing continued to play a major role in the region's organ building well into the eighteenth century, especially in small village churches where singing was the primary musical activity. New influences, however, came from cosmopolitan Hamburg, with its great organs, organists, and organ composers, leading the region into another blossoming of the organbuilder's art. The first Hamburg builder to work in Ostfriesland was Joachim Richborn (d. 1684), possibly a Stellwagen student; his organ in Buttforde (1681) is a landmark instrument. In the year of Richborn's death, a second Hamburg master, Arp SCHNITGER, began his organbuilding activity in the region. By 1691, Schnitger's focus had shifted farther west to Groningen, where he set up one of his workshops and monopolized the organ-building trade. The city of Groningen alone received three large Schnitger instruments, of which two survive, in the Aa-Kerk (orig. Akademiekerk, 1678; moved 1815) and the Martinikerk (1692). Nearby, well-preserved Schnitger organs are found in Eenum (1704), Godlinze (1704), Noordbroek (1696), and Uithuizen (1701). In Ostfriesland, the organ in Norden (1686–94) illustrates Schnitger's manner of building large instruments, while the smaller two-manual organ in Weener (1709–1710) represents the late Schnitger style as it was passed on to his sons Franz Caspar SCHNITGER and Johann Jürgen Schnitger (chris. 4 Sep 1690, d. after 1733). Schnitger was less dominant in Ostfriesland; other important builders with extant instruments include Valentin Ulrich Grotian (Pilsum, 1694), Joachim Kayser (Hohenkirchen, 1694–99), and Gerhard von Holy (Dornum, 1710–11; Marienhafe, 1710–13).

Schnitger's influence can be traced in the region long after his death in 1719; the Groningen workshop was operated in turn by Franz Caspar Schnitger, then ALBERT ANTONI HINSZ, then Franz Caspar Schnitger Jr. (1724–1799) in partnership with Hermann Heinrich FREYTAG, and finally by Heinrich's son Hermann Eberhard Freytag (1796–1869). The shop's approach to style did not completely ignore new influences, but the Schnitger tradition of careful voicing and outstanding workmanship remained. The rebuilt Martinikerk organ in Groningen (1729) illustrates the high quality of Franz Caspar Schnitger's work. Among the eight surviving Hinsz organs in the region are Appingedam (1744), Midwolda (1772), Uthuizer-meeden (1785), and Zandeweer (1731). A large number of Freytag's instruments, considered among the finest in Europe at the time, survive, including Finsterwolde (1808), Oostwold (1811), and Zuidbroek (1795).

Organ projects in Ostfriesland began to point in new directions, in part because of influences from the south. The instrument in Ochtersum (1734–37), built by the Westphalian organbuilder Christian Klausing (1687–1764), demonstrates the transition toward the refined classical sound that was taking hold throughout Europe as the eighteenth century unfolded. Heinrich Just Müller (1740–1811), another Westphalian, pursued this style, as found in small organs in Middels (1784–86), Neermoor (1796–98), and Simonswolde (1777). Müller's strongest competitor, Johann Friedrich Wenthin (1746–1805), built organs that survive in Backemoor (1783), Reepsholt (1788–89), and Groothusen (1798–1801). Dirk Lohman (1730–1814) was active in both Ostfriesland and Groningen; after completing the important organ in Hage (1776–83), the Lohman workshop moved to Groningen; one of the later organs stands in Farmsum (1829).

Classical elements in organ building in Groningen and Ostfriesland persisted well into the nineteenth century. Johann Wilhelm Timpe (1770–1837), who worked for Lohman and Freytag before establishing an independent business, produced excellent instruments both small (Middelbert, 1822) and large (Groningen, Niewe Kerk, 1831). After Timpe's death, organ building in the Groningen area was dominated by two family firms. One firm, founded by Petrus van OECKELEN, embraced the Romantic tradition, and remained active well into the twentieth century. Numerous instruments survive, including Beerta (1861), Garmerwolde (1851), Havelte (1819/1855), Hijkersmilde (1841), Middelstum (1863), Oude Pekela (1865), Sappemeer (1855/1866), and Saaxumhuizen (1851). The second firm, active from the late eighteenth through the mid-twentieth centuries, was the van DAM family of Frisia. Founded by Lammert van Dam, who apprenticed with Hinsz, the firm flourished in the nineteenth century under the leadership of his son and grandsons. Surviving organs from this period include Assen, Jozeficerk (1896), Garnwerd (1809/1834), Hoogkerk (1848/1867), Huizinge (1825), and Spijk (1884). An early twentieth-century van Dam organ is in Eelde (1915).

Nineteenth-century organ building in Ostfriesland also centered around several family dynasties: the Janssen family (founded by Gerd Sieben Janssen, 1802–1899), the Schmid family (led by Wilhelm Eilert Schmid, 1791–1856, and his uncle, Gerd Janssen Schmid, 1770–1845), and the Rohlfs family (founded by Johann Gottfried Rohlfs, 1759–1847, who apprenticed with H. J. Müller). The Rohlfs family was the most active in the area; many instruments are preserved, including the large St. Magnus organ in Esens (1848–1860) and a fine earlier instrument in Holtland (1810–13).

The most significant twentieth-century developments in the Ems-Dollart region center not around new organs, but around research, restoration, and even tourism. With its wealth of historic instruments, the region became an early focus for scholars and builders associated with the ORGAN REFORM MOVEMENT. Instruments have been restored, and even rerestored, as knowledge has increased throughout the century. The emergence of the Ems-Dollart organs as cultural treasures of worldwide significance was made possible by four important events: (1) the founding of the Jürgen AHREND and Gerhard BRUNZEMA workshop (Leer) in 1954, which quickly established itself as the leading shop for restoration and conservation; (2) the establishment of the Norddeutsche Orgelakademie (Bunderhee) by Harald Vogel (1977), which serves as a central research facility for study of the area's historic instruments and makes access to them possible for visiting builders, players, and scholars; (3) the Dollart Festival (1981), founded by Vogel, a recital series and competition which takes place on a broad selection of the region's historic organs; and (4) the Stichting organum Frisicum (founded 1994), which focuses on the instruments of the Ems-Dollart region. These historic organs are now featured attractions in this area of thriving, coastal resorts.

CLEVELAND JOHNSON

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EN CHAMADE REEDS

Stops with pipes placed in a horizontal position, placed so as to emerge from points on the organ FACADE (usually, but not exclusively toward its top) to represent a parley of trumpetlike instruments. The pipes, radiating from a central point, emitted sound from a distinctive spatial perspective, adding to the psychological "drama" of their role. But while a solo role seems inevitable for such stops, the visual effect was at least as important, part of the high Baroque interest in gilded splendor (in some cases, dummy pipes were used). The French term *en chamade* (from *battre la chamade*, "to sound a parley") was first applied in the late eighteenth century, but this type of stop was first developed in Spain (*languëtería de la fachada*) and Portugal (*palhetas de fachada*) in the previous century.

In a 1677 contract for an organ by José de ECHEVARRÍA I for San Juan Bautista in Mondragón/Guipúzcoa, the builder describes the installation of an 8' treble Clarín (a solo Trumpet) as follows:

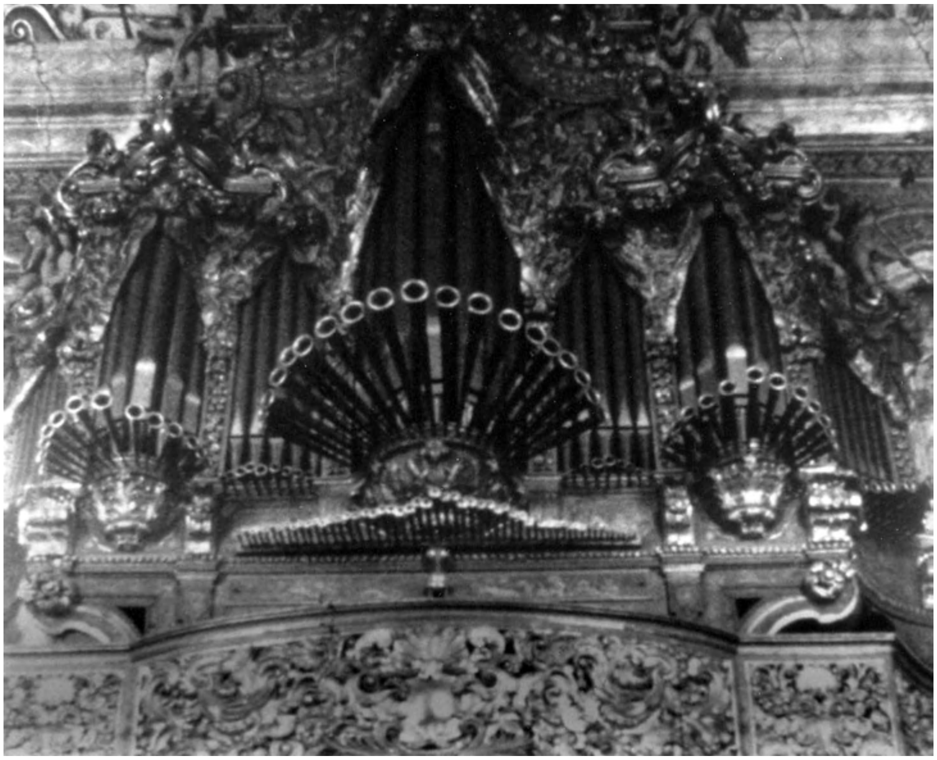

Fig. 33. Horizontal facade reeds: anonymous organ, ca. 1737, Capela de S. Miguel, University of Coimbra, Portugal (Photo by David J. Johnson).

> It is a stop which has not been built in any organ save that which I have made in the convent of San Diego de Alcalá de Henares [Eibar, Guipúzcoa, 1659] and by its excellence it will seem a great novelty, although the strangeness of said stop and its composition render it difficult to make. And this stop will have its own *tablón* [top board] with its wind conductors [and] the *tablón* will serve as the chest for the said Clarínes. These [pipes] will be placed in the main cornice in the form of cannons which will beautify all the facade of the said organ.

The builder also states that the Dulzaína pipes (a short resonator 8' Regal, bass and treble) will be disposed in the facade "as artillery." These reed pipes were hung on protruding iron rods. By 1700, the concept of facade reeds spread throughout Spain and Portugal and their colonies, but remained unknown elsewhere. Some freestanding Spanish organs have en chamade reeds on the back as well as the front side; Portuguese organs are usually flush against the wall with facade reeds always on the front side.

One difficulty involved the inner construction. The vertical TROMPETA REAL (basic to Iberian organs, and which continued in use alongside the en chamade stops) had a boot, where the pipe could be voiced by controlling the air flow through the bottom hole of the boot or by the curvature or thinness of the reed tongue. En Chamade reed pipes have no boot. With a full blast of air, but no boot, these en chamade pipes could only be voiced by the curvature or thinness of the reed tongue, a challenging task.

By facing the pipes horizontally without a boot, the already intense sound of the internal Trompeta real was magnified. Early designs had a pointed shallot, subsequently abandoned by other countries (although retained in Iberian organs). With a thinner reed tongue than in Northern European organs, a completely open pointed shallot, a bootless, full-throated installation, and a forward-facing position, the en chamade reed stops had their own uniquely vivid sound. Though not as loud as en chamade trumpets, the older vertical and internal Trompeta real had an intense, specifically German sound. A 1545 organ contract of Lérida Cathedral, Spain, refers to a "stop of natural trumpets in the German style, with their voices as strong as in all Germany." Similar stops are found in Uttum, Germany (orig. pipes, 1656) and the Schlägle monastery in Austria (1633/34). According to Porter, later Baroque German Trumpets had a more "silvery" sound, with an emphasis on the fundamental and lower partials; beginning in the late 1600s; they were constructed with a different shallot design from Iberian Trumpets, producing a very different sound more suited to contrapuntal music.

Most Iberian organs have DIVIDED STOPS. According to Wyly, "the custom of using registers of one pitch in one hand and another pitch in the other hand . . . would have caused the solo parts to move in and out among the other [accompanying] parts rather than stand above

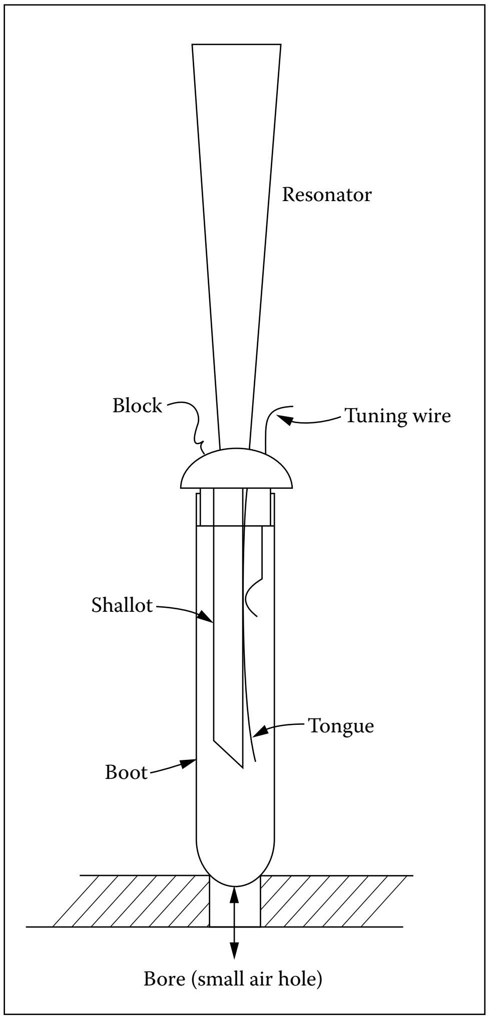

Fig. 34. Shallot and resonator with air hole, en chamade reed pipe.

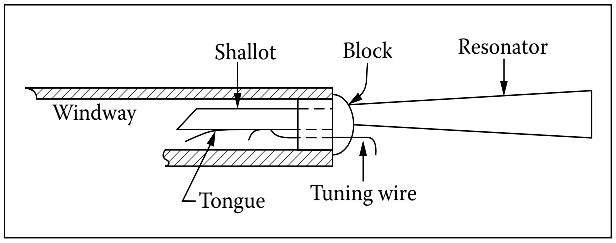

Fig. 35. Shallot and resonator with windway, en chamade reed pipe.

or below them. . . . Reed stops were preferred in many works which in modern times would be assigned to flue choruses. This is particularly notable in registrations specified for fugues." En chamade reed stops were very appropiate as solo stops, but one could also create a reed chorus by putting two 8' reed stops in the bass (LH) together with three 8' reed stops in the treble (LH), compensating for the greater power of the bass reeds. The following are Spanish en chamade reed stops (Portuguese equivalent in parentheses): Clarín: Trumpet, 8' RH (Clarim); Trompeta de Batalla: 8' LH (Trombeta [Trompa] de Batalha); Trompeta imperial: 32' RH (Trombeta [Trompa] Marinha); Trompeta magna: 16' RH (Trombeta [Trompa] magna); Bajon or Baxon: Bass Trumpet, 8' LH (Baixão); Bass Trumpet, 8' LH (no equivalent); Bajoncillo: Bass Trumpet, 4' LH (Baixãozinho); Violeta: Bass Trumpet, 2' LH (no equivalent); Chirimía: Trumpet, 4' LH and RH (Chirimía: short resonator, 8' LH and RH); Clarinete: 8' RH (same); Fagot: 8' LH (same); Oboe: 8' RH (Boé or Oboe); Cromorna: half-length resonators, 8' RH (no equivalent); Orlo: Regal, 8', 16' LH and RH (no equivalent); Dulzaína: Regal, 8' LH and RH (Dulçaina); Viejas: Regal, 16' RH, Viejos: Regal, 8' LH, Violín: Regal, 4' (no equivalents); and Voz humana: soft Regal, 8' RH (Voz humana: Celeste).

See also **Reed**

JANE L. JOHNSON

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ENGELFRIED, FRANZ XAVER (1805–1881)

German-American organbuilder. The Engelfried family workshop was founded in Muhringen, Württemberg by Alois Engelfried in the eighteenth century. He and his sons Franz Anton Engelfried (b. 1794) and Franz Xaver Engelfried completed several instruments in the Black Forest area, some of which are still extant. In 1853, Franz Xaver Engelfried and his family arrived in New York. Beginning in that year and up until 1875 his name and shop were listed in city directories. Two sons of Franz Xaver, Charles and George, first worked in the business of their father, then joined the firms of Hall, Labagh and Company (formed by Thomas S. HALL) and Hilborne L. ROOSEVELT.

Franz Xaver Engelfried tried to introduce German methods of design and construction to the New York organ market in the second half of the nineteenth century. None of his work survives, with the exception of a large organ case in St. Vincent de Paul in lower Manhattan. His organs used tracker ventil chests and box-bellows.

Martin Kares

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ENGLAND

Organ building in England began under the influence of Benedictine monasticism in the tenth century and flourished until the Reformation, when Protestant scruples and (later) Puritan hostility led to the destruction of many organs. The Restoration saw the resumption of normal activity; isolated from continental schools, English organs were characterized by the LONG COMPASS and a lack of pedals until renewed contact with France and Germany in the nineteenth century brought about radical change. During the second half of the century technological innovation and changing musical taste promoted the building of organs in a Romantic style; but by the 1950s this tradition was exhausted and classical influences reasserted themselves.

From the Beginning to the Civil War

In England, St. Dunstan (909–988) and St. Aethelwold (912–984) were key figures. Their Benedictine monasteries at Abingdon, Malmesbury, and Winchester acquired organs, probably during the two decades following Dunstan's return from exile in Ghent in 957. Ramsey had an organ with copper pipes in 991, but the most famous of the Anglo-Saxon organs was built (or rebuilt) by Bishop Alphege for Winchester, Old Minster, around 993 and celebrated in WULFSTAN OF WINCHESTER's poem (see Williams). The interpretation of the text is fraught with difficulties; a literal reading implies that the instrument had twenty-six bellows and four hundred pipes, and was blown by a team of seventy men.

Evidence survives for the existence, use, and repair of organs over the next three centuries (e.g., Ely, 1133; St. Edmundsbury, 1182; St. Albans, 1235) but technical details are almost wholly lacking. Most would have been small instruments, able to be carried in procession or set up beside an altar, but some seem to have been fixtures and therefore presumably larger (Canterbury 1174; Durham, 1264; Exeter, 1286). Growing demand must have stimulated and secularized the craft of organ building. By the early years of the fourteenth century, names of lay organbuilders are beginning to appear in the records. The earliest surviving contract dates from 1338: for the sum of eleven marks, Adam of Darlington agreed to build a new organ for York Minster; the Dean and Chapter were to provide "lead materials and other needful things" and Adam was to employ other workmen as necessary. The implication is that organ building as a secular occupation came of age during the fourteenth century, as did, apparently, the guild of "Orgelmakers" (first mentioned in the second decade of the 1400s).

Substantial organs fixed on galleries and pulpitums became more common during the century preceding the Reformation. Sometimes considerable expenditure was incurred—for example, Durham, ca. 1420 (over £26), St. Albans, 1438 (£50), Lichfield, 1482 (over £26), and, at Exeter, 1514 (more than £165!). Smaller organs were found in parish churches, located on rood screens or moved around as needed. Little is known about the design of these organs. Stops were in use by 1511, when the Lady Chapel at Butley Priory was given an organ "cum ii obstructionibus." In 1534 a second instrument with five stops was given, probably for use in the "quire" (choir). Other technical information remains elusive, although surviving contracts for organs at All Hallows, Barking (1519), and Holy Trinity, Coventry (1526), help a little. Both organs had a single keyboard with a probable compass of C-a'' (46 notes). "Dowble pryncipalles throw out" (see Barking) implies duplication of the CHORUS register, while pipe lengths (5' for the "pryncipalle"; 10' for the "Bassys called Diapason") indicate that this was a transposing organ. Both remained characteristic features of the English organ until the middle of the seventeenth century. The earliest surviving English organ case comes from this period (pre-1550); a particularly splendid example now in Old Radnor, Wales, it seems originally to have been associated with the royal court.

The evidence (for all its limitations) suggests the existence of a flourishing if idiosyncratic organ culture in England on the eve of the Reformation. This was all but wiped out in the attack on traditional religion begun in the 1530s. Organs fell into disuse; organbuilders such as the Howe family, the leading London builders between 1500 and 1570, lost their livelihood; and a 1563 proposal in Convocation to abolish the use of organs in divine service lost by only one single vote. A counterreaction set in by the last years of Queen Elizabeth I (1558–1603); within the Established (Anglican) Church one group rejected Puritan austerity and declared that the "beauty of holiness" should be given physical expression in worship through music and ceremony. A notable revival of organ building under the patronage of the court, the universities and the cathedrals followed, of which the primary beneficiaries were Thomas Dallam and his son Robert. Like those of the 1520s the organs built by the Dallams were transposing instruments with duplication of chorus registers. However, the largest of them now had two keyboards (Great; Chair Organ or Choir) and the cases were often of considerable splendor with embossed front pipes, painted woodwork, and a wealth of mannerist detail. In 1609 Thomas Dallam reconstructed the organs at St. George's Chapel, Windsor. He agreed to take down the "greate Organs" and reerect them on the screen alongside an existing "Chayre portative"; this episode helps illustrate how the two-manual organ evolved. Between 1599 and 1641 the Dallams built a succession of organs for prestigious locations, including Worcester Cathedral (1613, collab. T. Tomkins; stoplist survives). Despite the absence of reeds, mixtures, and Tierces, and the continuing absence of pedals in most instances, they were instruments of considerable refinement designed above all to be used in ensemble with a choir or instrumentalists.

This revival came to an end when the English Civil War broke out in 1642. In 1644 Parliament made an order "for the speedy demolishing of all organs" in churches. Other than a few hidden instruments that reappeared after 1660, most organs were, indeed, destroyed.

Continental Influence and the Eighteenth Century

The Restoration of the monarchy and the Church of England led to a renewed demand for organs. Robert Dallam was back in England by October 1660; he led the field until his death in 1665. Others who participated were Thomas Harris (d. ca. 1684; Robert Dallam's son-in-law); Dallam's sons, George and Ralph; and Lancelot Pease, Edward Darby, Robert Taunton, Robert Hayward, John Loosemore, and Thomas Thamar. The first post-Restoration organs differed little from those of the 1630s, with old-fashioned transposing organs with doubled chorus registers and no reeds or (with a few exceptions) mixtures.

By the time Thomas Harris died, his son Renatus Harris was building organs in a manner that fused early-seventeenth-century English organs with French-style dispositions, adding mixtures, reeds, and mutations. No longer transposing instruments, the organs still lacked pedals and began their keyboards at GG. The largest organs gained a third division (Echo); late in his career Renatus Harris built England's first four-manual organ (Salisbury Cathedral, 1710). Often housed often in cases of considerable splendor, these instruments offered English organists a greatly extended palette of tone colors.

But Harris's development was instigated by the arrival in England of the German-Dutch builder Bernard Smith in 1667. As early as 1671 he was described as the king's organmaker. Smith's Protestant status (Harris was a Catholic), coupled with court patronage, ensured a succession of commissions until his death in 1708. In the Netherlands, he had known and built small instruments without pedals, but with a much wider range of timbres than contemporary English instruments. Smith incorporated some of these into his English organs, and transformed the old transposing organ into one with long compasses. Most consisted of two divisions (Great, Chair), sometimes housed in a single case. The Cambridge University organ (1698) was typical:

Great (GG-c'''): 8.8.4.4.2-2/3.2.III.8.V (c')
Chair (GG-c'''): 8.4.4.2

Smith rarely used Echo divisions, sometimes placing their pipework unenclosed behind the music desk (Banqueting House Chapel, Whitehall, 1699). His instruments were admired in his own day, and was upheld as a standard of tonal excellence in some quarters until the mid-nineteenth century. His cases were less flamboyant than Harris's, though the architectural poise of the best of them is impressive. No organ by Smith or Harris survives intact.

The successors of Smith and Harris built organs in broadly similar styles to them. Christopher Shrider (d. 1751), and Christian Smith and Gerard Smith (fl. 1689–1730) carried on the Smith school; John Harris (d. 1743), John Byfield I and II, Thomas Swarbrick, and Richard Bridge (fl. 1730–60) represented the continuation of the Dallam-Harris pedigree. The two Abraham Jordans, father and son (fl. 1700–46), seem to have had connections with both. Distinctions cannot be drawn too precisely. In the circumstances of the first half of the eighteenth century collaboration was common, and a number of major instruments are attributed to partnerships of builders that formed or dissolved as need arose.

The most significant innovation in the first half of the century was the Swell division. The senior Jordan, its reputed inventor, introduced it at St. Magnus the Martyr, London Bridge, in 1712, but he may have picked up the idea while traveling in Spain or Portugal. It proved popular, and builders were soon converting Echo divisions into Swells. The possibility of giving expression to a melodic line was received enthusiastically, and a typical Swell would have four or five stops (8.8.4.III.8) played from a short-compass keyboard, normally commencing at c'.

Renatus Harris's last organ (St. Dionis Backchurch, London, 1724) had eight reeds among its twenty-five stops, testimony to the growing taste for imitative stops. French Horns, Vox Humanas, Cremonas, Trumpets, and Bassoons supplied the colors demanded by the expanding repertoire of solo voluntaries and (under Handel's influence) organ concertos. Other novelties including a "flute almain" (John Harris and Byfield, 1726), harp, dulcimer, and lute stops (Swarbrick, 1732), and drum pedal (Bridge, 1735). Organs were becoming larger and more complex. The Spitalfields organ had a sixteen-stop Great with two Open Diapasons, Principals, and Trumpets. St. Mary Redcliffe had a CC-compass Great. Few organs by the successors of Smith and Harris survive today. The altered instruments at Finedon (Shrider, 1717) and St. Mary, Rotherhithe (Byfield II, 1765) give some impression of the sound of this era's organs. Smaller survivals include the (altered) organ at Great Packington (ca. 1750), with its associations with George Frideric Handel, and the (little-altered) Byfield II chamber organ at Finchcocks, Goudhurst (Kent) (1766).

The organs of the mid-eighteenth century exhibit a growing refinement of both tone and mechanism. John Snetzler, an immigrant Swiss builder, satisfied the rising taste; his cylindrical Dulciana (soon a standard feature of the Choir organ) was the only one of his tonal novelties to meet approval. Other innovations included pedal pull-downs and a tremulant, but in general Snetzler adopted the prevailing style and received a number of important contracts. He built a succession of elegant chamber organs and was one of the first to streamline production by standardizing components and designs.

Samuel Green took matters a stage further. His interest in refining the mechanism, design, and manufacture of organs anticipated developments in the first half of the nineteenth century. Like Snetzler, he strove for delicacy of tone. Dulcianas were carefully deployed (including 4′); low cut-ups, close but light nicking, and constricted foot-holes were used for the Diapason chorus; the chorus of the Swell was now reasonably complete. Green constructed ingenious large swell boxes; one of the first to employ horizontal ("venetian") shutters (by 1787), his largest work, the twenty-five-stop organ in St. George's Chapel, Windsor (1790), was totally enclosed, as were some of his chamber organs. Green was making horizontal bellows for chamber organs by 1787, though he did not use them often in larger instruments. (Builders would replace the old diagonal "wedge" bellows with horizontal bellows after 1800.)

Nineteenth-Century Modernism

While Green's boxlike "Gothick" case and his attenuated Diapason choruses was typical of its period, his technological and tonal inventiveness heralded the radical remodeling of the English organ to meet a growing desire for variety and sensation. These developments were encouraged by an increased interest in choral and orchestral transcriptions, the rise of Methodism and the adoption of hymn singing by the Anglican Church, the culture of industrialization and technological innovation, and the boom in the building of churches at home and in the colonies. Independent Pedal pipes (initially 8' wooden pipes) appeared, replacing the pull-down in the 1790s; John Avery (d. 1807) was a pioneer (Westminister Abbey, 1793). Doubles (16') were rare until the 1820s; but J. C. Bishop and William Hill provided Pedal organs with reeds and even 32' registers in the 1930s. Registers favored during the eighteenth century (Cornet, Vox Humana, Bassoon) were superseded by novelties such as the Violoncello (Gray, 1798), Clarabella (Bishop, 1820), Harmonica (Ward, 1823; Elliot and Hill, 1830), Double Dulciana (Bishop, 1828), Flageolet (Elliot and Hill, 1830), Celestina (Elliot and Hill, 1831), and Clarionet flute (Gray and Davison, 1848).

There was a taste for contrasting tonalities and dynamics. Swell boxes became larger and more sophisticated; John Gray (fl. 1821–49; later partner in Gray and Davison) made a few organs with enclosed Choir divisions. Most three-manual organs built after 1800 had two Open Diapasons on the Great, but a number of instruments built during the 1820s and '30s attempted to increase power by duplication of other chorus registers, such as in the ambitious organ built by Elliot and Hill for York Minster (1829):

Great (West): 8.8.8.4.4.2_.2.2.III.IV.8.8
Choir: 8.8.8.4.4.4.2.2.8.4

Great (East): 8.8.8.4.4.2_.2.2.III.IV.8.8
Swell: 8.8.8.8.8.4.4.4.V.8.8.8

Pedal: 32.32.32.16.16.16.32.16

Reeds offered another means of increasing power. J. C. Bishop experimented with closed shallots to produce a smoother and more opaque tone quality. William Hill improved the sonority of chorus reeds in the Posaune (Birmingham, 1834) and Cornopean (St. Peter Cornhill, London, 1840), but his most sensational achievement was the world's first high-pressure reed. The Grand Ophicleide was added to the Birmingham organ in 1840; it was voiced on 15" wind, made possible by the development of a railway signaling device. By the 1830s, "progressive" organs were curious hybrids in which pedal pipes, imitative stops, Swell divisions, and mechanical accessories (e.g., Bishop's composition pedals, 1820) were grafted onto a tonal scheme that would have been familiar to any eighteenth-century builder.

More drastic change was at hand. With the publication of Bach's organ works and the British organ performances of Felix Mendelssohn (1832–42), English organists perceived the limitations of the native instrument. Others visited the European continent and saw how builders there had achieved desired power and volume, not through duplication or increasing pipe scales, but by a proper development of choruses in both manual and pedal divisions. H. J. Gauntlett, in collaboration with William Hill, revolutionized English organ design. C-compasses, Pedal choruses, full-compass Swell divisions to match the Great, and a plethora of novelty stops (strings, flutes, and reeds) were standard features of the resulting "German System" organ. In fact, this idiosyncratic blend of features drawn from English, German, and French national styles commended itself to some because it permitted the performance of the works of Johann Sebastian Bach and to others because of its expressive possibilities. The revolution was accomplished in a remarkably short time. In 1840, Mendelssohn's performance of Bach on Hill's new "German System" organ for St. Peter's, Cornhill, London gave the seal of approval to the new style. In 1841, Hill began work on a "German System" organ for the Great George Street Chapel, Liverpool; after several proposals were rejected, it was not completed until 1855:

Great (C-f'''): 16.8.8.8.5-1/3.4.4.2-2/3.2.1-3/5.III.
II.II.8.4.2

Choir (C-f'''): 8.8.8.4.4.2.8.8Solo (C-f'''):
8 (Tuba Mirabilis)

Swell (C-f'''): 16.8.8.8.4.4.2-2/3.2.2.III.II.V.16.8.8.8.4.8

Pedal (C-d'): 16.16.8.4.V.16

Hill's organs typically united English Diapason choruses (with Tierce mixtures), Dulcianas, and wood Stopped Diapasons with modern reeds and novelty stops. The latter included open flutes with inverted or conventional mouths, cylindrical strings, and tapering registers. The flutes appeared in 1840, the strings after 1843.

If Hill's inspiration was (loosely) German, another leading builder turned to France: Frederick Davison (ca. 1815–1889), partner of John Gray. Significantly, the influence was mechanical as well as tonal. During the 1850s, in collaboration with organist Henry Smart (1813–1879), Davison's firm built concert organs in which stop control and orchestral fidelity were crucial. The first, Glasgow City Hall (1853), had sub- and superoctave couplers, a tremulant, sixty-one-note compasses, and the pneumatic Barker lever, which was to prove invaluable in facilitating multiplication of chests and use of higher wind pressures. The Glasgow organ borrowed other ideas from Aristide Cavaillé-Coll: Harmonic Flutes, and an increasing pressure system for the chorus reeds among them. Other organs in the series developed all these features and exhibited further innovations: equal temperament (Birmingham Music Hall, 1856), ventils and free reeds (Crystal Palace, London, 1857), and a sforzando pedal (Newcastle upon Tyne, Old Town Hall, 1859). The Leeds Town Hall organ (1858) had ninety-three stops, an Orchestral Solo division with horizontally disposed pipework, crescendo pedals, and a pneumatic lever in all departments. These mechanical aids were but the beginning of a technological sea change in the Romantic organ.

On the other hand, Davison and Hill, together with practitioners such as Joseph Walker, George Maydwell Holdich (1816–1896), and the Robson, Bevington, and Bryceson firms, built mid-Victorian organs with much in common tonally with the organs of fifty years earlier. Mechanically, the largest instruments left something to be desired (the mechanical action at Leeds Town Hall was never wholly reliable).

For many Victorian organists, the organs of Henry Willis represented an ideal of tonal and mechanical refinement. Some contemporaries felt that his concert organs were more successful than his church organs on account of the orchestral character he imparted to all his instruments, but he was the first English builder to make church organs capable of filling vast spaces with sound. Willis was a consummate technician who approached tonal as well as mechanical questions as technical ones. His organ for St. Paul's Cathedral (1872), with its exemplary full Swell, high-pressure chorus reeds, characteristic solo voices, and divided cases (the connections made by tubular-pneumatic action running beneath the chancel), determined cathedral organ design for the next eighty years. His long list of inventions includes relief pallets, crescendo pedals, improvements in swell box movements, hydraulic blowing engines, and the "Wesley-Willis" radiating and concave pedalboard.

But Willis's most significant achievement was the creative application of the Barker lever, which he had studied on visits to France (1848, 1849). He patented improvements in the design of pneumatic levers and was the first English builder to use tubular-pneumatic action (1857); he later applied it to swell control (1861) and stop actions (Alexandra Palace, 1868). Its most influential use was arguably his pneumatic combination action, patented in 1851 and first applied in the seventy-stop organ for the Great Exhibition at Crystal Palace. Tonally, Willis's organs are unmistakable. The reeds have closed shallots, weighted tongues, and resonators of natural length; typically, the chorus reeds will be on 6” or 7” wind pressure. The fluework is often slotted, with dubbed lips and small toe holes. Tierce mixtures, Gedeckts, harmonic flutes, and orchestral reeds are found in all but the smallest instruments. Willis's great concert organs and his most significant cathedral instruments establish his claim to be reckoned among the great artist-engineers of the Victorian era. He built over two thousand instruments. Few survive unaltered, though Reading Town Hall (1864, 1888), St. George, Preston (1865), Union Chapel, Islington (1877), Blenheim Palace (1891), and Oxford Town Hall (1897) are exceptions. His influence cast a long shadow.

At the 1851 Great Exhibition, another influential organ was exhibited by J. F. SCHULZE of Paulinzelle, Germany (2/16). Its tonal finish and strength of tone were greatly admired and won Schulze a following in England. When the organ in Doncaster Parish Church was destroyed by fire, Edmund Schulze got the contract for a new organ (1857; 5/94). Schulze built several other smaller organs for England, but his influence was out of proportion to their number. His bold choruses with brilliant mixtures all voiced on low wind pressures offered an alternative to Willis's approach; the quality of his materials and workmanship compared favorably with many other English builders. His influence was disseminated through Hopkins and Rimbault's favorable responses; many native builders adopted features of his practice (Gedeckts, Lieblich Bourdons, Violones, Gemshorns, Hohlflötes, Quint mixtures). His example also encouraged the use of spotted metal and capacious soundboards and winding systems.

Schulze's organs were especially well-received in the north of England, and a number of Yorkshire builders emulated them: Brindley and Foster (Sheffield); Forster and Andrews (Hull); and Abbott and Smith (Leeds). On the other side of the Pennines, the Lancashire builders preferred the French style, inspired by Cavaillé-Coll's organ in Manchester Town Hall (1877). The two influences (German and French) were assimilated in the work of T. C. LEWIS. His choruses relied (like Schulze's) on low pressures, ample winding, and generous scales; his reeds, harmonic flutes, gambas, and celestes were French in style. Southwark Cathedral (1897; altered) was his firm's magnum opus.

By the end of the century, English organbuilders were sending instruments in large numbers to the colonies and dominions as well as the home market; they resorted increasingly to factory methods of production to meet this demand. The progressive builders were in the provinces. NORMAN AND BEARD, for example, built the most advanced organ workshop of the day in Norwich (1898), where they employed three hundred men. The metropolitan builders tended to be more conservative. Hill and Son's largest work, for Sydney Town Hall (1890), boasted 126 stops and a 64' reed, but the fluework was on 3”, the chorus reeds on 5”, and the tubas on 10”. The firm went on building similar instruments (albeit with fewer mixtures, more orchestral registers, and additional enclosure) until merging to form HILL, NORMAN AND BEARD in 1916. J. W. Walker and Sons were another firm that avoided extremes. They favored a substantial foundation of Diapasons balanced (at least until the 1910s) by mixture work; it was a sign of the times that their reconstruction of the York Minster organ in 1903 was regarded as “underpowered.”

Neoclassicism and Restoration

Power was increasingly desirable; among those willing to try new methods of attaining it was Robert HOPE-JONES. He worked first in England, where he secured a number of important contracts before emigrating to the United States in 1903. Hope-Jones was an electrical engineer who sought to apply his knowledge to the development of electric actions for organs (Willis had built an electric action for the Canterbury Cathedral organ in 1886, which functioned reliably until 1939). He also had radical ideas about the tonal development of organs. Mixtures and mutations were abandoned, chorus structure disappeared, string scaling was reduced to the minimum practicable, and there were no registers higher than a 2' Harmonic Piccolo. Harmonic Trombas, very narrow Trumpets, Diapasons with leathered lips (Diapason Phonon), and wide-scaled Clarabellas (Tibia plena, Tibia clausa) spoke on heavy pressures (in one scheme he proposed a Tuba on 100”). For the Pedal he patented the diaphone (1894), a valvular reed producing a prodigious output of foundational tone; it was later used (as were many of Hope-Jones's innovations) in the theater organ. Though his work was derided by many of his contemporaries (and recent critics), Hope-Jones's influence was considerable. Tonally, his organs were carefully finished, and his electric actions may have been more reliable than claimed. But so many distinctively scaled and voiced registers were difficult to blend, and the musical use of the instrument bore little relation to the demands of the repertoire. But his work on detached consoles, stop keys, expression chambers, and unit ranks was to be widely exploited in the first half of the twentieth century.

The dominant figure during that period was Arthur Harrison (1868–1936) of the Durham firm of HARRISON AND HARRISON. Like Willis in his heyday, Harrison commanded many prestigious contracts for cathedral and concert organs (he rebuilt Willis's huge Royal Albert Hall organ in 1921); the tonal finish of his firm's organs, complemented by the opulence of the consoles, was the equal of Willis. Sometimes the effect was unavoidably compromised by the reuse of old material, but the best Harrison organs are exemplary representatives of the English Romantic school. While the chorus structure used recalls Schulze and Lewis, the effect of mixtures and mutations in a Harrison organ is utterly different, not least because of Harrison's inclination to use leather on the lips of 8' and 4' Diapasons and to employ pressures of between 4" and 5". Another distinctive feature, a mixture type called "harmonics" (containing both the tierce and the flattened Twenty-first), was in theory defensible, but in reality contributed an acid, reedy effect that did not help the blend. Harrison's Greats had smooth-toned Trombas with harmonic trebles on anything between 7" and 12", sometimes enclosed (King's College, Cambridge 1934) while the Swell had a chorus of trumpets (with "harmonics") on perhaps 7". As in Willis's later organs the big Pedal reed was a climax stop, usually on the same pressure as the Tuba (15" to 20"). On the Solo, Harrison often developed a string chorus; there, and in the enclosed Choir, he would include a rich palette of accompanimental and imitative registers. For his Pedals he relied heavily on borrowing from the manuals and used extension freely. The organ for St. Mary Redcliffe, Bristol (1912) was apparently considered by Harrison to be his most characteristic work:

Great (C-c''''): 16.16.8.8.8.8.8.4.4.2-2/3.2.IV.16.8.4

Swell (C-c''''): 16.8.8.8.8.4.4.4.2.V.16.8.8.16.8.8.4

Choir (C-c''''): 16.8.8.8.8.4.4.2.8

Echo and Solo (C-c''''): 16.8.8.8.4.2.III.16.8.8

Pedal (C-g'): 32.16.16.16.16.16.8.8.4.32.16.16.16.8

The console accessories include the usual generous provision of combination couplers, sub- and superoctave couplers, tremulants, reversible pistons, and balanced swell pedals.

Harrison's only serious rival was Henry Willis III, whose great organs for Liverpool and Westminster Cathedrals (both 1926) had a forthright quality that was for some a welcome antidote to Harrison's refinement. The amalgamated firm of Hill, Norman and Beard and the Liverpool firm of Rushworth and Dreaper built a number of major instruments in the Romantic vein; John H. COMPTON concentrated on the development of the extension principle for organs of all sizes.

When organbuilders began to recover in 1945 at the end of World War II it became apparent to some that a change of direction was inevitable. The catalyst proved to be London's Royal Festival Hall (RFH) organ, opened in 1954. Designed by Ralph Downes and built by Harrison and Harrison, the RFH organ was an English version of the electic American NEOCLASSICAL ORGAN built by G. Donald HARRISON in the United States. There were 103 stops; each department had a complete Principal chorus with ample mixture work, and choruses of side-scaled flutes and mutations were present in all main divisions. Low wind pressures, open foot voicing, and a minimum of nicking contributed to an effect that enthralled as many people as it outraged. While Downes always insisted that the RFH was a "one-off," it was widely imitated. Eclectic specifications and electric consoles seemed to offer the best of both worlds to organists tired of ponderous Romantic organs but attached to their console accessories. The most successful organs in this genre were (understandably) those built from scratch: Coventry Cathedral (Harrison, 1962), Liverpool Metropolitan Cathedral (Walker, 1967), St. Clement Danes, London (Harrison, 1958), St. Albans Abbey (Harrison, 1962), and Gloucester Cathedral (Hill, Norman and Beard, 1971); the last three were built in collaboration with Downes. But all too often elements of the RFH approach were grafted onto existing organs; in the process, many fine Victorian and Edwardian organs were ruined.

A legitimate criticism of the RFH school was that it failed to apply classical principles such as tracker action and WERKPRINZIP tonal schemes. Between 1960 and 1971, the firm of GRANT, DEGENS AND BRADBEER built a series of organs, mostly with mechanical key action, housed in cases of a bold modern style and using contemporary materials. The stoplists were usually in German or French and owed something to continental firms such as RIEGER and SCHUKE. Many English organists found the tonal schemes unappealing (particularly for liturgical purposes), but the instruments demonstrated that large organs could be built with an acceptable mechanical action. Peter Collins and Nigel Church (among others) have built tracker organs in a contemporary style. Collins has a number of large instruments to his credit, combining mechanical inventiveness with stylistic variety.

In England the past is never far away; but the continental ORGAN REFORM MOVEMENT never really found a foothold. The recovery of historical organs gave (and would continue to give) the primary impetus to the postwar organ-building scene. In 1959, Noel MANDER restored the Adlington Hall organ (ca. 1693) and the Byfield II in St. Mary Rotherhithe, and attempted reconstructions of surviving organs in London. He built a large mechanical action organ (St. Vedast, Foster Lane (1962), bringing together an eighteenth-century case and pipework, and applied tracker action to the three manual departments; the Pedal, however, was electropneumatic. In a similar tracker action reconstruction at

St. Giles, Cripplegate (1970) electro-pneumatics were used (controversially) to play two high-pressure Willis reeds on the Great. While few of these reconstructions would now pass muster in purist circles, they influenced Mander's approach to building new organs and aroused interest in pre-Victorian English organs.

The weight of the RFH style and the more uncompromising classical organs built or imported during the 1960s and '70s eventually eased. The firm of J. W. Walker and Sons, rejuvenated by a move away of London, has since the mid-1970s concentrated on building trackers organs; in most cases their tonal schemes stand firmly within the English tradition. The same could be said of Mander. His reconstruction of Victorian and Edwardian organs during the 1980s inspired attempts to build new organs in a similar style, at St. Andrew, Holborn, London (1989), St. John's College, Cambridge (1994), and Chelmsford Cathedral (1994). The Chelmsford disposition follows.

Great (C-a'''): 16.8.8.8.4.4.2-2/3.2.III.III.8.4.V

Swell (C-a'''): 8.8.8.4.4.2.III.16.8.8.8.4

Choir (C-a'''): 8.8.4.4.2.II-III.8

Pedal (C-f'): 16.16.8.8.4.16.8

At the same time a more disciplined approach to restoration has established itself. Restored organs include: Wollaton Hall (ca. 1690), St. Paul's United Reformed Church, Liss (ca. 1740), St. Mary's, Lulworth Castle (Seede, 1785), Holywell Music Room, Oxford (Donaldson, 1790), Everingham Catholic Chapel (Allen, 1835) and the tubular-pneumatic organs in All Saints, Hove (Hill, 1905) and the Albert Hall, Nottingham (1910). Some builders have put their experience in restoration toward building new "historic organs": William Drake (Grosvenor Chapel, London, 1991) and Goetze and Gwynn (St. Lawrence, Whitchurch, 1994).

English organ building today presents a diverse picture. Some continue in a modified version of the Downes-Harrison approach, with eclectic tonal schemes and the console facilities available from modern computer technology. Others build mechanical key actions, drawing inspiration from earlier instruments, but (again) avail themselves of the registrational advantages of electric stop action. A third group builds new organs in a particular historical style and works closely with the early music movement in the minefields of pitch, temperament, technique, and performance practice. There is every reason to believe that such diversity will prove a strength in the future.

Nicholas J. Thistlethwaite

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ENGLAND

English organ-building family about which biographical information is limited. George England (active 1759–65; d. ?London, 1773) is first mentioned in a 1759 organ contract for London, Dulwich College (case survives). By 1763 he was working in London, Clerkenwell, Wood's-Close, previously Richard Bridge's (d. 1758) address; he seems to have married Bridge's daughter and taken over his business. He built instruments for Gravesend, St. George's (1764; partly extant) and London, St. Stephen's Walbrook (1765; Rococo case survives). His work mixed influences of Smith and Harris; he experimented with scalings, and used a Mixture (Twenty-sixth) to produce bell sounds. He apparently retired in 1766, receiving tuning fees until his death.

John England (active ca. 1766–1789; d. ca. 1790) was most likely the brother of George, whose business he took over in 1774. He had partnerships with Hugh Russell (b. London, ca. 1731; d. 1825; later worked with John Abbey) and, later, his son George Pike England. John England's known workshops were in London

(1776–89). He built instruments at Wilshire, Wardour Castle (1767); London, St. Michael, Queenhithe (1779, with Russell; case now at Chelsea, Christ Church); Abingdon, St. Helen (1780, with Russell and John Byfield); London, St. Mary Aldermary (1781, with Russell); Sussex, Marble Hall, Petworth House (1786; case survives). John's instruments were similar to George's, although with more reed stops.

George Pike England (?1765–1816) is first mentioned in account books (London, St. Mary Woolnoth, 1788). He took over his father John's workshop, moved it to Rathbone Place (1794), and remained there until his death. George Pike was a prolific builder; the following instruments survive, at least in part: London, St. James, Clerkenwell (1792); Dorset, Blandford Forum, St. Peter and St. Paul (1794; case, pipework extant; rest. Mander, 1970); London, St. Margaret, Lothbury (1801); Belfast, Second Non-Subscribing Presbyterian, Rosemary Street (1806; moved to Newry/Down, First Non-Subscribing Presbyterian; reb. 1979); Shropshire, Shifnal, St. Andrew's (1811); Norwich, St. Stephen, 1813 (now at Norfolk, Cawston, St. Agnes); and London, St. Mary Magdalene, Holloway Road (1814; rest. Willis, 1867). George Pike's style represents the conservative style of late eighteenth English organ building, following the path laid by Renatus HARRIS and Bridge (especially the latter's effective Swell division) minus the more radical elements of Samuel GREEN's work. He followed trends of the period such as more varied scaling, a second Open Diaspason, a Dulciana on the Choir organ, and two chorus Mixtures. Joseph WALKER worked with the England firm, and pursued an alternative course to WILLIAM HILL.

RICHARD KASSEL

ENGLER

German family of organbuilders. Johann Engler the Younger (d. before Sept 1694) was the son of Johann Engler the Elder; his father was a carpenter and city council member in Neusiedel am See. Johann the Younger settled in Breslau (now Wroclaw, Poland), where the record of his marriage in 1674 states that he is an organbuilder and maker of instruments. Michael Engler the Elder (fl. 1682–96), brother of Johann the Younger, also moved to Breslau, marrying in 1682; he is also listed as an organbuilder and instrument maker. In 1695 he remarried, and in 1696 an infant son died. It appears that both brothers were much involved with building stringed instruments.

Michael Engler the Younger (b. Breslau, 6 Sept 1688; d. there, 15 Jan 1760),the most famous member of the family, likely apprenticed with his father Michael the Elder and thereafter worked with a Breslau organbuilder (perhaps I. F. Menzel), and with builders from other areas. After about 1720–21 he seems to have entered into business for himself. In 1722 he married in Breslau; three years later he became a freeman there. Altogether he built about forty one- to three-manual organs. He strived for a well-developed Principal chorus, employed mixtures containing Tierces, and added a large number of foundation stops, including strings (also available at 16' and 4' pitch), flutes, and reeds. In larger instruments such as Brieg (Brzeg), St. Nikolai (1724–30; 3/48; destr. during World War II), Grüssau (Krzeszów), St. Marien (1732–39; 3/54; extant), and Olmütz (Olmouc), St. Mourice (1740–45; 3/44; rest. Sindler, 1963–67), he added a transposing mechanism to the second manual that shifted from Chorton to concert pitch a full tone lower (the norm for other instruments); he also provided some concert pitch stops in the Pedal. His last instruments were finished by his son Gottlieb Benjamin, with the assistance of his son-in-law Carl Gottlieg Ziegler (1731–1768). The last twenty years of his life corresponded with the three Silesian wars, which hindered, prolonged, and damaged his work.

Gottlieb Benjamin Engler (b. Breslau, 1734; d. there, 4 Feb 1795), son of Michael Engler the Younger, apprenticed with his father from 1750 to 1755. Upon his father's death he took on the firm and the responsibility of completing his father's unfinished instruments, notably Breslau, St. Elisabeth (1750–1761; 3/56; destr. 1976). This situation complicated the launching of his own career; costs were rising, but the client churches did not want to cover the increases. In the organ for Glogau (1774–75; 3/35) he expanded the keyboard and pedal compasses. His manual mixtures included Tierces, as had his father's. In the Carmelite church in Wohlau, he repaired and expanded the 1716 Adam Orazio Casparini organ after the church's vaulting collapsed in 1781.

Johann Gottlieb Benjamin Engler (b. Breslau, 28 Sept 1775; d. there, 15 April 1829), son of Gottlieb Benjamin Engler, apprenticed with his father, who died before his training was complete; he completed his studies with another and received his certification in 1795. Until about 1800 he worked with Johann Christian Benjamin Müller (1771–1847), a former apprentice of his father. J. G. B. Engler was characterized as being a good if rather slow builder. He designed the case of the Breslau Cathedral organ (built by Müller), and built several positives for well-to-do citizens, a teaching organ for the Lehrerseminar in Breslau (1812), and smaller church organs, including Schwarzau bei Lüben (Lubin; 1797), Peterwitz bei Schweidnitz (Swidnica; 1800–05), and Breslau, Nikolavorstadt (1811). He improved the construction of bellows, his voicing skills were very refined, and his reed stops were of excellent quality. Departing from earlier traditions, his organs moved closer to using equal tempered tuning.

Douglas E. Bush

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ENGLISH HORN/COR ANGLAIS

An imitative reed stop of 8' or 16' pitch. The French stop is older (nineteenth century), cylindrical, and less smooth than the twentieth-century American stop, with its double-bell construction (Skinner). Neither should be confused with Robert Hope-Jones's utterly different English Post Horn, known on theater organs as the English Horn, brassy and strident in quality.

ENGLISH ORGAN ARCHIVE

See British Institute of Organ Studies; Organizations

ENHARMONIC ORGAN

Makers of keyboard instruments have, since the sixteenth century, tried to devise ways for tuning them in purer intervals than normal temperaments allowed. Subsemitones (split accidental keys) were the normal means; by splitting the key and having each half connected to a separate action and pipe or string, it became possible to have separate G♯ and A♭, for example. This worked well in meantone temperaments, where the number of keys used was limited, but toward the end of the eighteenth century, when more chromaticism and more compromised tuning systems were coming into use, instrument makers began searching for other means. In 1768 William Parker built an organ for London, Foundling Hospital Chapel, with sixteen notes to the octave. Four of the five black keys (excluding F♯) had two pipes per note, but these were brought into operation not by split keys, but by sliders in the windchest.

As equal temperament began to come into use during the eighteenth and early nineteenth centuries, it brought about a new wave of experiments in justly tuned organs, especially in England and America. In 1811 the Rev. Henry Liston of London made an abortive attempt at devising an organ where the pitch of the accidentals could be altered by shading the pipes. Midcentury saw two more successful efforts. In England, T. Perronet Thompson designed an organ, built by Thomas Robson, with a keyboard having more than twelve notes to the octave. He claimed that it was easy enough for even a child to learn to play (having taught his own daughter how to do it) and exhibited it at the Crystal Palace in 1851, but it failed to gain recognition. In America a somewhat different organ was built in 1849–1850 by Joseph Alley and Henry Ward Poole of Newburyport, Massachusetts. This had a normal keyboard, and, while the patented design showed a complex mechanism for shifting the key action from one note to another, the completed instrument fell back upon the simpler system of sliders used earlier by Parker. This effort briefly stirred up some interest, but while one of the two instruments built was purchased by a Boston church, no further orders resulted.

In 1868 Poole devised a keyboard of thirty-five notes to the octave, and Alley built a reed organ with this keyboard. Later attempts along this line were made in the 1880s and '90s by Collin Brown of Glasgow and J. P. White, a Boston piano technician, who built at least three reed organs that he called "Harmons." Although the Alley instrument has disappeared, one of White's instruments is in the instrument collection of New England Conservatory, and one of Brown's in a museum in Tacoma, Washington. In the 1930s, the American composer Harry Partch designed a justly tuned organ he called the Ptolemy, which he and a London organbuilder, Edward Malkin, built while Partch was on a travel grant there. In addition to a typewriter-type keyboard, Partch included "keyboard translations" of the Tonality Diamond, which became the best known of his theoretical ideas. The fragile Ptolemy did not survive its journey to California, Partch's home.

See also **Tuning and Temperament**

Barbara Owen

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ENOCQ, ÉTIENNE

See Hénoch (Enocq), Étienne

EQUAL TEMPERAMENT

The normal type of keyboard tuning in modern Western music, whereby the octave is divided logarithmically into twelve equal semitones. Each major third is tempered larger than pure by nearly 14 cents, and each major sixth by nearly 16 cents; the equally tempered perfect fifth is only about 2 cents smaller than the just perfect fifth. With a few significant exceptions, equal temperament was seldom used on the harpsichord or clavichord. It was well known on lutes, but keyboard players complained that it sounded "dissonant" or that it failed to lend variety to the different keys. In some recent theoretical writings, the term "equal temperament" may refer to any division of the octave into equal parts. Equal temperament became the standard by the mid-nineteenth century; in the aftermath of the Organ Reform Movement, some builders returned to the meantone temperaments of the Baroque era.

See also **Tuning and Temperament**

Richard Kassel

ERBEN, HENRY (1800–1884)

American organbuilder. Erben was the foremost American builder of the second and third quarters of the nineteenth century. Not until the 1870s was he overtaken by competitors in volume of output. In quality of materials and workmanship he was seldom approached and never surpassed; even the smallest of his surviving organs have action parts of walnut and chest tops of mahogany.

Erben, born in New York on 10 March 1800, was the son of Peter Erben, organist of St. John's Chapel, who may have built instruments as well. It is probable that Peter and Henry Erben assisted Thomas S. Hall in setting up the new organ there in 1813. Henry became Hall's apprentice shortly afterward. In March 1824, the two formed a partnership. Erben, six years younger, was clearly the stronger man; in March 1827, he became sole owner of the company, and for the next sixteen years, Hall worked for him. Erben continued building organs virtually until his death in New York on 7 May 1884, even though during his last years two former partners, William Wilson and L. C. Harrison, set up competing firms, both claiming to be "successor to Henry Erben."

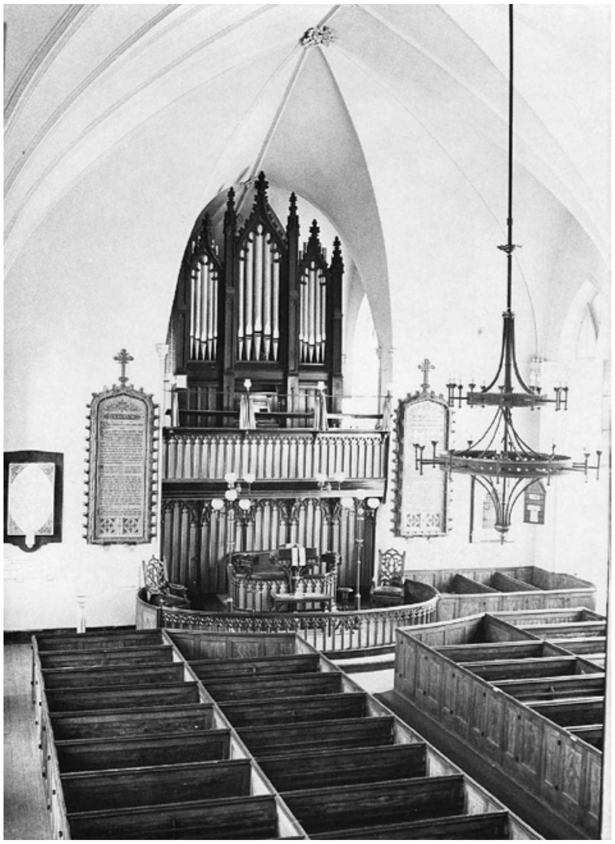

Fig. 36. Henry Erben organ, 1845 (2/15), Huguenot Church, Charleston, South Carolina (Photo by William Van Pelt).

From the beginning, Erben's clientele was national; only New England, with its own distinctive group of organbuilders, resisted his overtures. He enjoyed a good bit of patronage in the southern states, right up to the Civil War and thereafter. His basic market remained New York churches; he built nearly 150 instruments for them, the most famous (and largest) for Trinity Church (1846).

Except for the extending of the keyboard compass from G down to C, Erben resisted the post–Civil War trends in American organ design. He continued to build cased instruments rather than chambered installations, and made no use of electric key or stop action. His tonal designs were based on modest pipe scales and lower cut-ups, full ensembles including mixtures, chorus reeds, and relatively few orchestrally imitative stops.

Probably because so many of Erben's clients were wealthy, and could afford to replace older organs, little of his work has survived intact. Only two three-manual instruments are known: an original installation in (Old) St. Patrick's Cathedral, New York (1869), and an 1850 organ built for the Monumental Church in Richmond, Virginia, and now in Trinity Methodist, McLean, Virginia. Several smaller Erben organs exist in substantially original condition, among them those of the Huguenot Church, Charleston, South Carolina (1845) and First Moravian, New York City (1863).

JOHN K. OGASAPIAN

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ERZÄHLER

A stop invented in 1904 by Ernest M. SKINNER, who describes its tone as a hybrid, neither flute, string, nor diapason. The tone is light and bright, with the first harmonic (octave) sounding prominently. Skinner used it frequently, most often at 8' pitch, and occasionally at 16' or 4'. Its pipes are made of metal, conical in form, with the top diameter one quarter of the mouth diameter. This German term means "narrator" or "storyteller."

See also **Stop**

EDWARD L. STAUFF

ESTEY

American reed organ firm. The company stands with that of MASON AND HAMLIN in importance in the history of the REED ORGAN in the United States. In contrast to the founders of Mason and Hamlin, however, Jacob Estey (1814–1890) had little interest in things musical. The son of a farmer, he was apprenticed to a plumber in his early teens, establishing his own shop in 1835 in Brattleboro, Vermont. Estey operated the shop successfully until 1857, although he began turning his focus toward organs during this period. This was occasioned by the activities of one Greene, a maker of melodeons who had established his business in 1846 and rented the upper story of Estey's shop.

In 1852 Estey bought Riley Burdett's share of the melodeon building firm of Burdett and Carpenter, which then became E. B. Carpenter and Company and moved into Estey's plumbing shop. In 1853, Isaac Hines, Estey, and H. P. Green formed a new company, while Carpenter formed an association with Samuel H. Jones. From 1850 to 1855 Estey built approximately two thousand organs; in 1855 he sold his plumbing business, bought out Hines, and turned his attention to Estey and Green. In 1856, Estey bought out Jones and George Woods, thus bringing the firm of Jones, Carpenter and Woods into the Estey and Green fold. Estey later bought out Carpenter's interest. In 1857, the factory burned, but a new factory was soon built. Even with the time lost because of the fire, the firm produced 640 organs in the five-year period following it.

In 1863, Estey bought Green's share in the company, becoming sole owner. Shortly after, another fire partially damaged the factory, but new facilities were soon built. In 1866 the company was again reorganized, the former firm dissolved, and the Estey Organ Company came into being, with Julius J. Estey, his son, and Levi K. Fuller, his son-in-law. The latter part of the century was taken up by a patent infringement lawsuit between Estey and one of his former partners, Riley Burdett, who by this time had his own reed organ business; after a prolonged dispute, Estey emerged as the victor. He also became involved in piano making in the 1880s.

Jacob Estey left control of the firm to his sons Julius J., Jacob Gray, and Julius Harry Estey. In 1901 the Estey company began building pipe organs, at first small standardized models with tubular-pneumatic ACTIONS, in a Brattleboro department run by William E. HASKELL. It also built models that could be played automatically from perforated paper rolls, much like a player piano. At the turn of the century, signs of a loss in the reed organ's popularity began to be apparent. The piano, the player piano, the phonograph, and the new mobility afforded by the automobile brought about much competition and price-cutting among the remaining reed organ makers. Nevertheless, in 1917 *Musical Opinion* reported that the Estey firm had recently built its 400,000th organ.

During the 1920s Estey adopted more forward-looking ideas in building its organs. Electric BLOWERS were placed within the organ cases, and the cases themselves were given a more contemporary styling. A Student Organ was produced with two manuals and pedal, self-contained blower, two sets of reeds on each manual and on the pedal, a thirty-note pedalboard that conveniently folded up, stop tablets, mechanical action, and swell pedals for each manual. Smaller organs were made, such as a Children's Organ and a larger Junior Organ. Somewhat later, a Practice Organ with two manuals and pedal was developed, with American Guild of Organists (AGO) specifications observed. Several smaller instruments were produced with lesser specifications, modern styling, and self-contained electric blowers.

The apogee of reed organ building in the United States was reached in the 1930s with Estey's "Virtuoso," a two-manual and pedal organ with ten sets of reeds, electro-pneumatic action, a full complement of couplers at 16', 8' and 4', and a console and pedalboard built to AGO specifications. Although the instrument was excellent, relatively few were made, due to competition from Electronic Organs. In 1953 Estey merged with the American branch of Rieger; Rieger organs for the U.S. market were built at Estey's pipe organ plant.

Although the firm declared bankruptcy in 1956, the Estey name lingered for some time; the electronic organ division was taken over by Magna Electronics in 1959. By 1961 the firm, now Estey Electronics, Inc., was advertising small electronic "organs" with two short manuals and an octave of pedals. Estey did not forsake reed instruments entirely; a 1970 advertisement displays an instrument of two manuals of thirty-two and thirty-sven keys plus forty chord buttons and stainless steel reeds; six other models are mentioned.

In 1971, Estey became the Estey Division of Miner Industries, Inc., with headquarters in New York and factory at Harmony, Pennsylvania. Miner Industries acquired the Magnus Organ Corporation in 1975, which marketed a small toylike instrument based on an inexpensive harmonica with plastic reeds developed during World War II. Miner produced these instruments plus an Estey line of "portable" organs, said to be the first of their kind and the forerunner of similar electronic instruments. In January 1978 Miner Industries filed for Chapter 11 bankruptcy, ending the Estey presence in the organ industry. Estey, which produced some of the finest reed organs ever made, concluded its career producing instruments little better than toys; nonetheless, respect must be paid to a man whose name remains significant after 115 years.

See also **Electronic Organ; Reed Organ**

James H. Richards

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EULE

German organ-building firm. August Hermann Eule (1846–1929) established a workshop in 1872 after being inspired by Carl Voigt (Halberstadt) and Balthasar Schlimbach (Würzburg). In 1888 he moved the workshop to its present building in Bautzen, Saxony. Until 1901 Eule built predominantly mechanical cone-chests; thereafter they used pneumatic bellows-chests, based on the cone-chest principle. Eule's biggest instrument is at Bautzen Cathedral (1910; 3/62; still extant).

Eule's only son was killed during World War I; his daughter Johanna (1877–1970) managed the firm from 1929 until 1957. After building small instruments with complete mechanical slider-chests through the 1930s, Eule built its first big slider-chest organ (1936). In 1957 Johanna Eule's adopted son Hans Eule (1923–1971) took over the leadership of the growing company. The firm built the largest new church organ in the former German Democratic Republic (Zwickau, Cathedral, 4/77) and exported to Sweden, the USSR, and West Germany. After Hans Eule died, his wife Ingeborg Eule (b. 1925) ran the firm until 1988, when Armin Zuckerriedel, who had been designer and head of the workshop for years, became co-director. Denationalized in 1990, the firm had a staff exceeding forty employees by 2002.

Restorations under the leadership of Helmut Werner have been of a consistent high quality, including the Gottfried Silbermann organs in Glauchau (1730) and Ponitz (1737); Altenburg (H. G. Trost, 1739); Naumburg (Z. Hildebrandt, 1746); and Wittenberg (Ladegast, 1864). Important new Eule organs include Berlin-Spandau, 1996 (3/51); Leipzig, Musical

Academy, 2002 (3/60); Tel Aviv, University, 2002 (3/39); and Leipzig, St. Nicolai. 2004 (5/102).

Christoph Keggenhoff

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EUPHONE

A free-reed stop of 16' or 8' pitch. This was the name of a tenor or baritone tuba similar to the baritone horn, a member of the saxhorn family invented in the 1840s by Adolphe Sax. The stop appeared from around 1820, and the first recorded example was at Beauvais Cathedral in 1827–29, thus predating Sax's instrument by at least fifteen years. In 1790 Ernest Chladni invented an instrument of the same name using glass plates and rods, but it is difficult to imagine how such an instrument could have inspired an organ stop of this type. It is possible that the stop's inventor simply made up the name from the Greek *euphony* ("sweet sound").

The original Euphone had resonators that Wedgwood describes as "cylindrical in body, terminating in a long cone." It was capable of expression by varying the wind pressure via a console device; as with all free reeds, it did not go out of tune with changes in wind pressure, unlike striking reeds. Another expressive Euphone was introduced by Sebastian Erard in 1830, featuring covered, slotted, somewhat balloon-shaped resonators and broad, thin tongues. Euphones have been made with other resonator forms or with no resonators at all. Its tone also varies considerably; Irwin calls it "muffled, reedy, somewhat pungent," while Audsley calls it "open, smooth and full."

See also **Stop**

Edward L. Stauff

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EXHAUST-PNEUMATIC ACTION

See Action

EXHIBITIONS

See World's Fairs and Exhibitions

EXPERIMENTAL ORGAN

Under this heading are grouped a variety of often highly unconventional instruments based wholly or partly on the pipe or reed organ. The majority of them have been developed since the 1960s by musicians and artists for concerts, installations, and exhibitions, mostly investigating the sonic possibilities of exaggerating single aspects of pipe organ construction. These experimental organs usually feature the greater expressive possibilities of variable wind pressure, normally a feature of the bagpipe rather than the organ. Tuning And Temperament have been concerns of some builders.

Around twenty microtonal pipe and reed organs were built during the nineteenth century, primarily for acoustic research. They were mostly tuned in just intonation, sometimes with equal temperament for comparison; many of them featured unconventional keyboard layouts, with up to one hundred keys per octave. These were followed during the first half of the twentieth century by a similar number of microtonal reed organs (and pianos), of which half—primarily commissioned by composers—were tuned in quartertones. Some of these were constructed by builders such as Flight and Robson/Robson and Sons, T. A. Jennings, Schiedmayer, E. F. Walcker, Steinmeyer, and Förster. The last half-century has seen a return of interest in enabling a conventional keyboard to be switched between equal temperament and just intonation or meantone tuning, initially in instruments built for the Norwegian composer Eivind Groven (just intonation), and exemplified since around 1980 in organs built by Charles B. Fisk (meantone); several electronic organs have also featured microtonality.

A microtonal pipe organ with an unusual keyboard layout is the thirty-one toonsorgel (thirty-one-tone organ) constructed in 1950 by B. Pels & Zoon in Alkmaar for Adriaan D. Fokker (now in the Teyler Museum, Haarlem). Based on the theories of Christiaan Huygens in the sixteenth century, it features two 143-note manuals in which white, black, and blue keys are arranged in eleven overlapping rows, and is tuned in equally tempered one-fifths of a tone (close to meantone). A portable electronic version is called the Arcifoon (Archiphone). A substantial repertoire of music has been composed for these two instruments.

Much less conventional are organs built recently by musicians and artists. Horst Rickels's constructions include Mercurius Wagen (Mercury Chariot), in which two performers at a semicircular console operate small bellows with their fists and feet, each powering one of sixty organ pipes that are suspended or mounted on

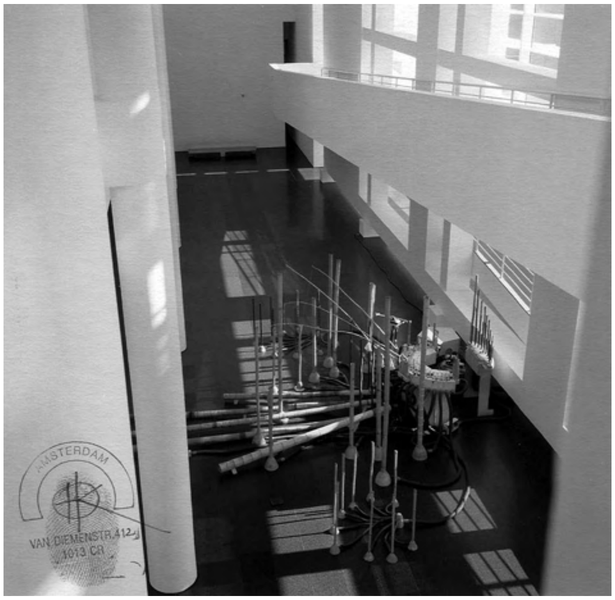

Figure 37. Bambuso Sonoro, built by Hans van Koolwijk, at Museu d'Art Contemporani Barcelona, Spain.

individual stands, spread out in front of the console. The similar visual appearance of Hans van Koolwijk's Bambuso Sonoro belies a more sophisticated selection of console controls and a greater range of sounds, including mixtures, "glissando flutes," variable wind supply, variable wind pressure, and vibrato control, using ninety-seven bamboo pipes. Also from the Netherlands is Peter van Haagen's Heveskesorgel, in which the addition of helium to the variable wind supply permits the production of glissandi over the range of more than an octave.

Other bellows-powered instruments include David Jacobs's Wah Wahs, Yoshi Wada's Adapted Bagpipe series, and Godfried-Willem Raes's ensemble of twenty-four Pneumaphones, while extremely low frequencies are exploited in Günter Demnig's Infraschall (Infrasound). Instruments have also been based on the nineteenth-century pyrophone, in which heated air or ignited gas causes pipes to sound, including Trimpin's computer-controlled Fire Organ (glass pipes) and two constructions that in performance resemble small blast furnaces: Bastiaan Maris's Large Hot Pipe Organ (20 pipes) and Michel Moglia's Orgue à feu (Fire Organ; 250 pipes).

Not all such instruments were constructed for experimental music. From 1990 on Martin Riches built a computer-controlled pipe organ to imitate speech sounds, primarily using metal reeds inside resonator pipes whose shapes resemble those of the vocal tract when enunciating different phonemes. Leland W. Sprinkle's Great Stalacpipe Organ (1954–57), in the Luray Caverns, Virgina, is not a true organ, but employs a five-octave, four-manual organ console (also playable automatically) to control the striking by rubber-tipped pistons of sets of tuned stalactites. The experimental element may be purely visual, as in the "exploded" wooden pipes at the front of the organ case designed by the architect Frank Gehry for his Walt Disney Concert Hall (2003) in Los Angeles.

The open-air surrealist "*orgue de la tramuntana*" for the medieval hilltop Quermançó castle in Catalonia is being built by Albert Blancafort; its main wind source is the Pyrenean "tramontana" wind, concentrated via a giant funnel, but it can also be powered conventionally. The sound is "disharmonious and surreal." The painter Salvador Dalí, who once attempted to purchase the castle, had the idea for such an organ in the late 1970s.

See also **Electronic Organ; Enharmonic Organ; Reed Organ; Subsemitones**

HUGH DAVIES

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EXTEMPORARY RECORDING

By definition, any performance is either extemporary, rehearsed, or somewhere in between. But the organ's adaptability to mechanical recording, the method used in automata of all kinds in the centuries before electricity, was limited to machines that used pinned cylinders, perforated cardboard strips and tin discs, and treadle-operated rolls. Of these, only the cardboard strips and rolls had any possibility of being "notated" during a performance. This was made possible by a pneumatically driven device, the "melograph" (melodiograph), which "recorded" a performance on a strip or roll of paper; the result could then be "reproduced" with a "melotrope." (This methodology was later applied to Charles Seeger's melograph, invented for and used in ethnomusicological analyses.) Eventually the melograph mechanism was built into organs and pianos, playable by human hand or mechanical fingers.

Although the reproducing player piano was developed first, the reproducing organ dates from 1910, built by important player piano companies (Welte Organ Company, Æolian Company) and organbuilders (Skinner, Moller). But the vast majority of rolls for these instruments were arranged, with organists' inscripting the variables onto the master rolls. A few important players made "live" recordings, and the various systems allowed for corrections. Not surprisingly, most organists wanted to play the large-scale instruments of the churches where they worked, not an electro-pneumatic device limited to two manuals and less spectacular pipework and subtlety; the majority of player organ rolls provided popular music and arrangements of classical music warhorses. Furthermore, the market for player organs was smaller than player pianos, although some smaller churches used them in lieu of an organist's salary. (Some instruments allowed "performers" to control tempo, phrasing, and muting with pedals; one could thus provide accompaniment for the most rhythmically wayward of congregations.)

The important organ recordings of the 1930s (e.g., Albert Schweitzer and the French school of composer-performers) and the introduction of recorded improvisations were made possible by the development of electric recording. The newly invented microphone and its attendant technology, whether in situ (churches) or via wire, allowed performers to make recordings playing significant music on the instruments for which it was intended.

In the years since the end of World War II, extemporary recording has been as readily possible as a tape recorder (first analog, later digital) or a computer-driven keyboard that "remembers" what a player has performed and, in an updating of nineteenth-century procedures, allows direct editing to create a definitive aural reproduction or written score of the "piece."

See also **Player Pipe Organ**

Richard Kassel

EXTENSION ORGAN

Modern term for an instrument making significant use of the principle of making individual ranks of pipes available at different octave or overtone pitches; not to be confused with the coupler, which connects entire keyboards. A mechanical approach is described by Michael Praetorius, where a stop channel with the chest of a single rank is grooved and palleted to supply each key with two or more pipes (later called *duplexing*). English builders used the term *communication* (later called *duplication*) when allowing one rank of pipes to be accessible by two or more manuals or pedal.

Although employed for size or economic reasons, extension became far more common with the introduction of pneumatic and electro-pneumatic means in the nineteenth century. George A. Audsley termed this a unit organ. Duplication became the basis of what Robert Hope-Jones and others would later call unification. Audsley made a distinction between this approach and "borrowing" (or "transmission"), a rank extended beyond a single manual to make it available at another octave or octaves (e.g., one fifty-six-note compass providing stops ranging from 32' to 1'). Duplication and borrowing could be found on a single instrument (nineteenth century). The unit chest was a further evolution of the extension principle; in the twentieth century, the electric unit chest allowed each pipe to be played by any key in whatever combination. In the first half of the century, the development of multiplex technology, with its ability to communicate two or more signals along a single path, gave the extension principle further viability through electronic and digital means. This was the basis for the theater organ.

Smaller extension organs remain in favor with contemporary builders for the familiar reasons of size and economy, with an emphasis on good blending and variety rather than dynamic level and the potential for individuality and sonic naturalness. However, the popularity of extension in nineteenth-century instruments and in restorations of that period can lead to technical problems with unintended borrowings of stops and notes, unsynchronized attacks between pipes and manuals, and unevenness of tone. In addition, its prevalence in electric action organs gave this innovation a less than stellar reputation. In the latter half of the twentieth century, many organ restorers did as much as possible to eliminate extension technology from the instruments they worked on, especially those that had originally been restored using that approach.

Richard Kassel

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F

FABRICIUS, WERNER (1633–1679)

German composer, organist, and organ expert. A pupil of Heinrich Scheidemann and a friend of the builder Christoph Donati the Elder, Fabricius served as organist at the Paulinerkirche and Nicolaikirche in Leipzig. His *Unterricht, wie man ein neu Orgelwerk . . . probiren soll*, one of the most comprehensive treatises ever written on the subject of the examination of new organs, was completed at an unknown date and apparently not published until 1756. Had the work appeared in print in a more timely manner, it might have precluded the necessity for Andreas Werckmeister to address similar matters in his *Orgel-Probe* volumes. The twelve keyboard preludes contained in Fabricius's *Manducijo zum General Bass* are ordered by successive keys and include original fingerings.
See also **Fingerings, Historic**

Vincent J. Panetta

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FACADE (FAÇADE)

The sculptural wood carving, metal work, and display pipes that make up the visible exterior of the organ, hiding all functional components of the instrument except the console; also called the front. From its humble beginnings as furniturelike cupboards for portatives and other small organs, the case evolved into distinctive symmetrical shapes. In the late Gothic, one flat of one or more chests might be surrounded by taller, castellated chests, forerunners of the pedal tower. The chests were often protected by shutters or wings that, like altarpieces, revealed paintings when opened. Other possibilities included partial screens with metal grillwork, linenfold paneling, and other design elements carved into the case, and roods and other sculptural elements breaking up the basic linear design of the case.

As the Renaissance sensibility prevailed, variants on the two-tower case emerged in Italy—for example, putting two small chests in between the tower, or reversing the pattern by placing the tallest pipes in one central tower and the middle and small pipechests to the side. However, in most other regions (and into the Baroque era), cases comprising three to as many as seven towers (alternating flats with towers) became the norm in large church instruments, with the largest tower in the center. Incorporation of the Rückpositiv into the main case resembled a miniature version of the Hauptwerk at a lower tier (Brustwerk).

Decorative friezes (cresting) and other filigree became the norm, as did finials crowning towers and other chests on top. Lozenge-shaped chest openings, rounded towers, carved oval and circular compartments, elaborate screen filigree, urn and case carvings, and marquetry reflected the increasing dominance of the curve in all Baroque architecture and, by extension, its organ. Another crucial element, DISPLAY PIPES (whether functional or dummy), saw changes in taste ranging from painted and stenciled fronts (a style that would return in the Romantic era) to gilding or silver plating. Although uniformity was the goal, spotted pipe metal tubes were sometimes left untouched. (French organ pipes were often painted blue; Romantic-style colored enameling and gilding are once again in fashion.) The placement of EN CHAMADE REEDS combined the extra projection of sound to the visual impact of brass instruments blowing out from the case. Large symbolic images might have placed on the upper part of the Hauptwerk or towers, perhaps a religious shield or royal coat of arms; even a well-placed star could focus attention on the upper case. The inner architecture and acoustics of the church in which the instrument was being built, including the placement of stained glass windows, often had considerable influence on the design.

The most grandiose development of the high Renaissance and Baroque, however, was the placement of statuary, more often decorative rather than functional, on any available tier or pipe tower. The most popular figures were Christian holy figures and musical angels and cherubs "playing" instruments mentioned in Psalm 150 and other biblical passages (and more recent inventions like violins and viols). In certain cases, figures would move when the appropriate stop or pedal was activated. (More secular figures, including Greek telamons and caryatids and busts of Johann Sebastian Bach, might be found in instruments outside the church.) At its most spectacular (or garish, depending on one's viewpoint), the Baroque organ epitomized the ideal-in-miniature of the architect who built cathedrals, royal residences, and other grandiose buildings, turning an almost two-dimensional collection of chests into a three-dimensional extravaganza.

The second half of the eighteenth century saw simultaneous trends: the late flowering of the Baroque style; the Rococo builder increasing the amount of filigree to compensate for fewer sculptural elements; and a simplification of line away from the curve back to a linear construction. The nineteenth-century organ reflected an architectural renewal of interest in the Gothic era, as reflected in literature and painting. The largest instruments retained their monumentality, neogothic finials became the rage, and the figures that did remain were far more restrained in quality than their Baroque predecessors. In many designs, the tallest tower was moved from its central position, symmetrically paired, and placed on the outside or an inside position. Pipes were once again painted; the wood were varnished and even antiqued, both techniques that may have damaged the wood in the long run.

In an opposite approach, some nineteenth-century instruments dispensed with all decorative elements, in an era when technological innovation became the primary focus of organ building (as represented by Aristide CAVAILLÉ-COLL and his European and American contemporaries). Pragmatism and the increasing use of electrical control over all facets of the instruments continued the tendency toward architectural simplicity, as the neogothic aesthetic gave way to modernism. What these changes in taste didn't complete, the economic devastation of World War I and the influence of the ORGAN REFORM MOVEMENT accomplished.

By the 1930s, the concept of the decorated facade had given way to an undecorated, unenclosed case, where the visual qualities of the wood and metal became dominant. After World War II, some builders utilized more radical modernist elements or eliminated the case altogether, producing novel arrangements of the pipes; in such designs, the pipes functioned as facade, chest, and case as well. The NEOCLASSICAL ORGAN movement saw a gradual return to true (if unadorned) case and chest; as neoromanticism began to hold sway, painting, enameling, and gold and silver leaf were once again decorating tools of the organbuilder.

RICHARD KASSEL

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FACHETTI, GIOVANNI BATTISTA (CA. 1475–AFTER 1555)

Italian organbuilder, also called Facchetti, Fachettis, Facheto, Facchinetti, and Brixiensis. Fachetti, an important Brescian builder, was active from 1515 to 1552. Numerous contracts testify of his activity, particularly in Emilia-Romagna, Lombardy, and Venice. He is best known for the organs at S. Maria in Vado, Ferrara (1516), Chiesa dei Frati di S. Giovanni, Brescia (1517), S. Michele, Bologna (1524), S. Benedetto Novello, Padova (1526), S. Pietro, Rome (1530), Cremona Cathedral (1542–47), Genoa Cathedral (1552), and the rebuilding of Lorenzo da Prato's organ at S. Petronio, Bologna (1528–31).

The specifications for the organs at Genoa and Ferrara survive. The Genoa organ has two Tenori ranks, Ottavi, Quintadecima, Decimanona, Vigesimaseconda, Vegesimasesta, Vigesimanona, and Flauto in ottava, and a fifty-note keyboard compass (F', G', A' to a''). The tenori reeds are made of fine tin, the largest reed measuring about eleven feet. The Ferrara organ replaces one Tenori with a Contrabasso 21’, but otherwise is virtually identical to the Genoa instrument. As with most Italian organs of the time, there were no independent Pedal stops. Fachetti’s larger organs at S. Eufemia, Brescia (1537), Piacenza Cathedral (1539), and S. Sisto, Piacenza (1544), however, had pedalboards with twenty keys.

Fachetti preferred a more brilliant intonation than that used by the ANTEGNATI family; together, they are considered the most influential builders of the early Brescian organ. One organist at the Brescia Cathedral wrote in 1542, “It is true that Magistro Jo Jacobo [Fachetti], I believe, does not have an equal in the world in this art [organ building], especially in a large church.”

THOMAS CIMARUSTI

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FAGOTTO/BASSOON/BAJÓN

(1) The Orchestral Bassoon, an imitative 8' reed stop. French builders of the eighteenth and nineteenth centuries sometimes split the Oboe rank, placing Bassoon pipes in the lower half to “match” an orchestra’s double-reed section (Basson-Hautbois); this had the disadvantage of unequal tone between the registers, and the practice was eventually abandoned.

(2) A chorus reed stop of 8’ or 16’ pitch, soft-toned with a long, narrow resonator, from the late Renaissance on; it could be open or stopped, cylindrical or conical, double-capped or idiosyncratic in shape. The Spanish Bajón (8') usually had flaring metal resonators and was consequently stronger in tone.

FAIRGROUND ORGAN

SEE MECHANICAL ORGAN

FANBOARD

SEE BALANCIER

FARRAND AND VOTEY

Organ-building firm based in Detroit. Edwin Scott Votey (1856–1931) received his early training at ESTEY, then a leading REED ORGAN manufacturer. In 1881, a group of skilled reed organ builders formed the Detroit Organ Company, which proved unsuccessful; in 1883, C. J. Whitney, a successful music dealer in partnership with Votey, bought the business, incorporating it under the same name. During the same year, William R. Farrand joined the firm, undertaking the financial management while Votey was in charge of the manufacturing aspects. In 1887 Whitney retired, and the company name was changed to Farrand and Votey. The firm built pipe organs and reed organs as well as pianos; in 1893, it purchased the patents and business of the Hilborne L. ROOSEVELT Organ Works of New York. A number of important instruments were built, including New York, Æolian Hall (1893), Chicago, World’s Columbian Exposition (May–Nov 1893), and the New York home of Andrew Carnegie (1900). By 1896 Farrand and Votey had built some 41,010 reed organs.

In 1895 Votey invented the Pianola, a self-contained pneumatically operated piano-playing device. Housed in its own cabinet, it had sixty-five fingers that protruded from the back of the case, the whole apparatus being pushed up to the piano keyboard so that the wooden fingers rested on the correct piano keys. The device was foot-pumped and operated from a perforated paper roll. Farrand also produced a PLAYER PIPE ORGAN named the Olympia, which operated from a paper roll like its piano counterpart. Votey, who was particularly interested in the player piano, left to join the ÆOLIAN COMPANY in 1897, buying out the pipe organ and player piano departments of his old firm. The company’s name was changed to the Farrand Company, and particular attention was given to the development of the Cecilian, a highly sophisticated player piano. Reed organs were made under the Farrand name, pipe organs under the Votey name, and player pianos were built for Æolian.

In 1901 the pipe organ division was sold to the Boston organbuilder George S. HUTCHINGS, who changed his firm’s name to Hutchings-Votey. The company went bankrupt in 1915.

JAMES HOWARD RICHARDS

FEEDER BELLOWS AND MAGAZINE

SEE BELLOWS

FELSBERG

Swiss organ-building firm. Founded in 1890 as METZLER Orgelbau and located in Felsberg near Chur, the

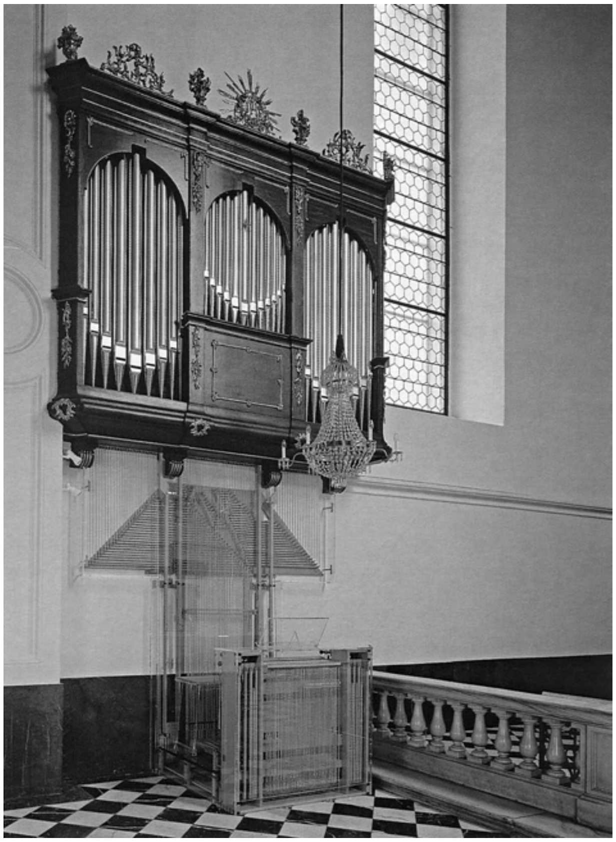

Fig. 38. Orgelbau-Felsberg (Photo courtesy of Douglas E. Bush).

firm was initially engaged in building, restoring, and caring for organs in the Swiss canton of Graubünden and its neighbors. Metzler's sons took over the business, relocating the main workshop to Dietikon (near Zurich) in 1930 and continuing work in Felsberg as a branch operation. In 1968, Metzler and Söhne agreed to let Richard Freytag take over the Felsberg workshop, which he reopened as Orgelbau Felsberg in 1968 and resumed a full schedule of operation. Quality of workmanship and tonal beauty of individual instruments has been the aim and hallmark of the firm. Since 1998, Freytag's son Michael, also a skilled organbuilder, has been a partner in the business.

The shop cultivates the building of mechanical action organs, including solid wood construction. With numerous centuries-old organs surviving and being restored, their tonal beauty has been rediscovered and their construction proven enduring. With a small team of craftsmen and artisans, Felsberg implements its knowledge of these historic instruments when designing new instruments. The company has its own cabinet shop and makes its own organ pipes.

Felsberg has built significant organs both in Switzerland and elsewhere, including more than one hundred new tracker organs and over thirty restorations of historic instruments; among its important new instruments are (in Switzerland unless indicated otherwise): Tamins, Evangelische Kirche (1975; North German style); Colmar (France), St. Martin Cathedral (1979; 3/48); Fribourg, Christ Roi (1984; after Callinet); Lausanne, St. Paul, (1986; after Schnitger); Lausanne, St. Laurent, (1990; first Spanish-style organ in Switzerland); St. Margrethen, Evangelische Kirche (1992; after Silbermann); Geneva, St. Gervais (1995; seventeenth-century Norman); Corsier, Protestant Church (1996; seventeenth-century Flemish); Habikino, Osaka, Japan, Concert Hall (2000; 3/43); and Bèthune, France, St. Vaast (2001; after Schnitger, 3/45).

Restoration work includes: Bagio (Phillipines), Cathedral (1988); Neuchâtel, Musée d'Art et d'Histoire, 1768 Jaquet-Droz organ (1990); Bangalore (India), St. Mark's (1993); and Klosters, Evangelische Kirche, 1686 Elias Köberle organ (1994).

ROMAN CANTIENI

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FERRIS, RICHARD M(ONTGOMERY) (1818–1858)

American organbuilder. Born in New York on 19 March 1818, Ferris became an apprentice in the shop of Henry ERBEN in 1830, where he learned organ building from the firm's foreman, Thomas S. HALL. A misunderstanding between Erben and Ferris resulted in the premature conclusion of the indenture in 1835. In 1841, Ferris began work on his own in New York. After a brief partnership with Henry Leaman (?1810–1877), he formed a second partnership with William H. DAVIS in September 1844; after 1849, both men worked separately under their own names. Ferris's career was curtailed by health problems beginning in 1856, and a stroke the following year paralyzed him; he survived until 6 December 1858, dying in his native city. He was succeeded by five half-brothers: Levi U. STUART (1827–1904), William J. Stuart (1828–1904), Louis J. Stuart (1834–1883), Henry C. Stuart (1836–1875), and George John Stuart (1830–1919). Ferris's stepfather, William Stuart (1798–1853), was also active in the firm.

Ferris's largest organs were built for Calvary Episcopal (1847), Calvary Baptist (1853), and All Souls Unitarian (1856) in New York, and Strong Place Baptist (1853) and St. Charles Borromeo (1854) in Brooklyn. While most of his clients were located in New York, he supplied instruments for patrons as distantly located as Chicago, Columbus, Mississippi, and Galveston, Texas. In total, Ferris built about sixty or-

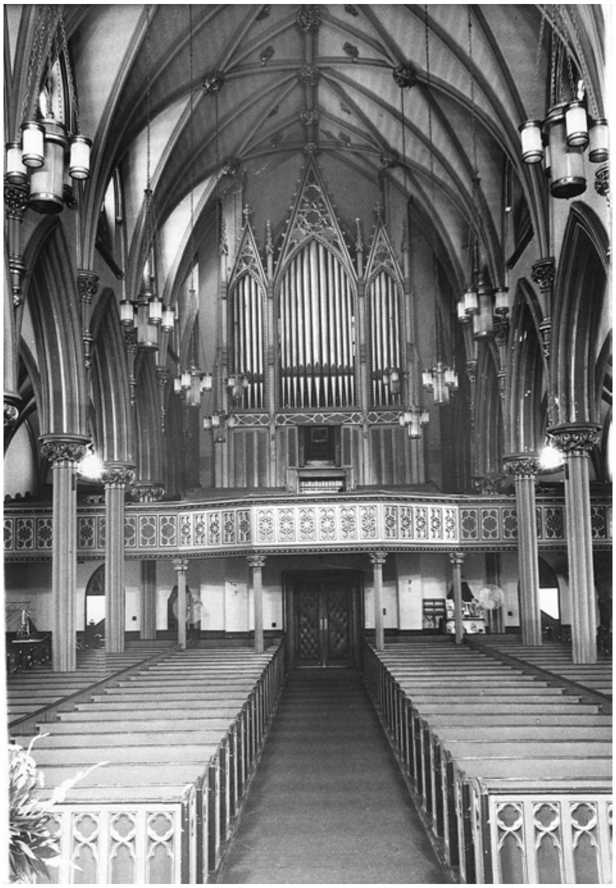

Fig. 39. Ferris & Stuart organ, 1858, St. Mary's Roman Catholic Church, Norfolk, Virginia (Photo by William Van Pelt).

gans between 1841 and 1857. According to his contemporary, the important church organist Edward Hodges, Ferris was New York's finest pipemaker in the 1850s, and is known to have made pipes for other builders. His instruments were characterized by magnificent, freestanding cases, exquisite workmanship, and refined voicing.

Ferris's shop also trained a number of men who became prominent organbuilders in the succeeding generation, including John H. and Caleb S. Odell and Reuben Midmer. Ferris is primarily remembered today for the organ built for Calvary Episcopal, New York City, now at the Auditorium in Round Lake, New York (rest. Andover, 1977). It is believed to be the oldest large, American-made, three-manual organ in nearly intact condition.

Stephen L. Pinel

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FEYRING, PHILIP (1730–1767)

German-born American organbuilder. Born in Arfeld, Westphalia, on 5 September 1730, Feyring emigrated to Philadelphia (ca. 1750), establishing himself as a maker of harpsichords and spinets. He built large organs in Philadelphia for St. Paul's (1762), St. Peter's (ca. 1764), and Christ Church (1766; 27 stops). These instruments were highly regarded, although few details about them have as yet surfaced. Feyring's instruments were played by American composers such as Benjamin Carr, Francis Hopkinson, and Rayner Taylor. Feyring died in Philadelphia on about 27 October 1767 of consumption.

Stephen L. Pinel

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FIFTEENTH/SUPEROCTAVE

A foundation Diapason stop, with ranks of 2' on the manuals and 4' on the Pedal, speaking two octaves above the depressed key; it is the Fifteenth by virtue of the intervallic difference, the Superoctave as "the octave above the octave." It adds a brilliant element to any mixture. German organs used *Superoktave* from the late Renaissance on, while English instruments used *Fifteenth* before switching to the German term in the nineteenth century.

FINCHAM (AND SONS)

Australian firm of English origin. The firm's founder, George Fincham (1838–1910), was the son of a London builder, Jonathan George Fincham (1769–1863), all four of whose sons worked in the organ trade. George Fincham served an apprenticeship with Henry Bevington (1843–49) and as foreman for J. C. BISHOP (1849–51). In 1852, he emigrated to Melbourne, capital of the newly separated colony of Victoria, then in the midst of a gold rush and population boom. Fincham earned sufficient funds to buy land, then built a house and factory in the Victoria suburb of Richmond. The first organ of the George Fincham Organ Company went to the Congregational Church, East Melbourne (altered; extant). He used local materials and made his own pipes whenever possible. Fincham's first public success was at the 1866 Intercolonial Exhibition in Melbourne, where a 1/10 instrument won first prize. He subsequently submitted successful entries to exhibitions in Melbourne (four times), Adelaide, Launceston, and Hobart; all instruments were eventually dismantled. Surviving instruments include Melbourne, Australian Church, 1890 (4/53; reb., moved to University of Melbourne, Wilson Hall, 1956); Warrnambool, St. Joseph's, 1893 (3/34); and Melbourne, St. Mary Star of the Sea, 1899 (3/37). Most of his instruments were two-manual church organs.

A strong proponent of protectionist policies, Fincham supported a tariff that by 1879 stood at 25 percent on organs and parts from outside Victoria. The amount and application of the tariff fluctuated as late as 1920; during this period, the government tacitly recognized the monopoly that the Fincham firm and its competitor, Josiah E. DODD, held on the country's organ trade.

George Fincham opened branches (or representations) in five other cities; an Adelaide branch opened in 1881, run by former apprentice Arthur Hobday as Fincham and Hobday; this branch was sold to Dodd in 1894. Hobday returned to Melbourne in 1888, continuing the partnership until its dissolution in 1897. George survived a lengthy illness (1897–1900); continuity was assured when his son Leslie V. Hunter Fincham (1879–1955) became a partner in George Fincham and Son (1901); Hunter, as he was known, took over the firm at his father's death. The firm was incorporated as George Fincham and Sons Pty. Ltd. (1920), forming a partnership with ex-employee Charles Ivor Matthews (who became a son-in-law). Upon Hunter's retirement in 1947, his son George Bowring Fincham took over; he was succeeded by his son David Fincham, who had worked with TAMBURINI. The firm is now located in the Melbourne suburb of Branley.

George Fincham no doubt visited the 1851 Great Exhibition at the Crystal Palace, London, where he would have seen the Henry WILLIS seventy-stop organ with its enlarged pedalboard (to thirty-two keys), pneumatic lever action, and combination pistons, and the Edmund SCHULZE instrument, with its effective flue choruses; he had direct experience with Bishop's use of composition pedals to replace shifting movements, inclusion of concussion bellows, and Bishop's Clarabella stop. George Fincham's Australian organs incorporated all these elements; his tracker instruments used square-based actions, not stickers; he began using pneumatic levers and tubular-pneumatic action from the 1880s, when his business was at its height.

RICHARD KASSEL

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FINGERINGS, HISTORIC

The evidence we have from the sixteenth through nineteenth centuries concerning fingering shows that while keyboard techniques went through several stages during that time, legato playing was generally less legato before ca. 1800 than after. Also, Renaissance and Baroque organists would make lateral shifts (taking two notes in succession with the same finger) and stretches not involving the thumb (e.g., to play sixths with fingers 4 and 5) far more often than a Romantic organist.

As more and more players today tend to use early fingerings for early music, makers of Renaissance- and Baroque-style instruments alter their organs to favor these players in designing such aspects of the instrument as voicing, touch, and octave span. Since early fingerings produce nonlegato playing, these instruments should not have too much CHIFF in the pipes. Lateral shifts will work best if the key-dip and the weight of the touch are minimal; the stretches will be less awkward if the keys are narrower than on a modern instrument.

The following discussion surveys the broadest historical trends. This will provide the background for an appreciation of the exceptional cases when they are encountered.

Main Historical Sources and Trends

From sixteenth- and early-seventeenth-century Germany two sets of fingered exercises survive in the prefaces to Elias Nikolaus Ammerbach's anthologies of 1571 and 1583 and two pieces that are almost completely fingered in the original sources: a hymn set-

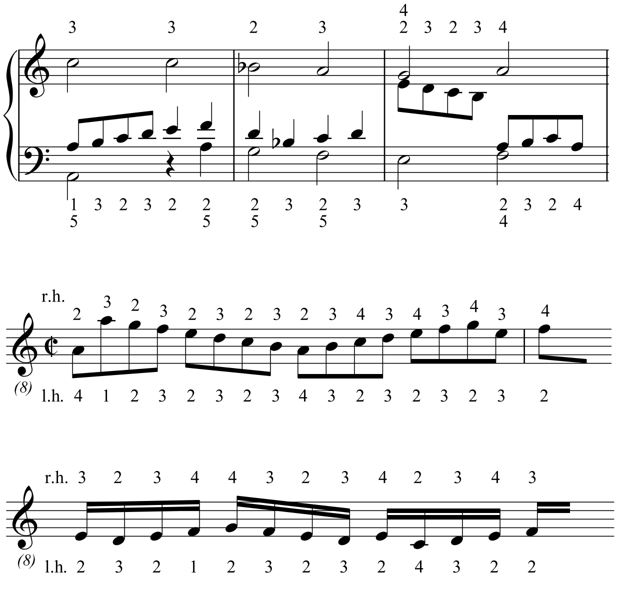
3 3 2 3 4 2 3 2 3 4
1 3 2 3 2 2 2 3 2 3 3 2 3 2 4
5 5 5 5 4
r.h. 2 3 2 3 2 3 2 3 2 3 4 3 4 3 4 3 4
(8) l.h. 4 1 2 3 2 3 2 3 4 3 2 3 2 3 2 3 2
r.h. 3 2 3 4 4 3 2 3 4 2 3 4 3
(8) l.h. 2 3 2 1 2 3 2 3 2 4 3 2 2

Fig. 40. Fingering before 1650, from top: Hans Buchner, Fundament Buch, excerpt; Christian Erbach, ricercar, excerpt; Elias Nikolaus Ammerbach, exercise (1571), excerpt.

ting in Hans Buchner's *Fundament Buch* of ca. 1525 (ms F.i.8a, Basel University Library) and a ricercar by Christian Erbach (ca. 1570–1635) in a manuscript of ca. 1625 (mus ms 1581, Bayerische Staatsbibliothek, Munich). Buchner and Erbach liked to reserve 3 for rhythmically weak notes in a melodic line, but Ammerbach evidently fingered in groups of four and would use 3 just as readily for strong as for weak notes.

Buchner and Ammerbach gave rules for fingering harmonic intervals. Ammerbach implied that each kind of interval should always be played with the same fingers, no matter what the context; Buchner said that a sixth expanding to an octave should be fingered 5/1 (1 = thumb) instead of the more usual 5/2. Later treatises give such simple rules for harmonic intervals—thirds to be played with 4 and 2, fifths with 5 and 2, and so on—that one is tempted to dismiss them as merely a guide for beginners. In such a case, a nonperforming musicologist might give useful information to a historically minded performer, but not any practical answers.

From Italy and Spain there are discussions of keyboard technique in tutors and prefaces, but almost no music with fingerings. Girolamo Diruta (before 1562–after 1609), a disciple of Claudio Merulo, included a substantial discussion of fingering as well as other aspects of organ playing (but no fingered music) in his *Il Transilvano dialogo sopra il vero modo di sonar Organi*, I (Venice, 1593). In scales, 3 was to take the rhythmically weak notes; the left hand (LH) would ordinarily descend (2)3232 . . . and either hand should move toward the center of the keyboard (4)3232 . . . (although some players would ascend with 1 and 2 in the LH); rhythmically weak notes might be taken with 1 or 5 if they came just before a leap of more than a fifth. In Bologna fifteen years later, Adriano Banchieri (1568–1634) in his *Conclusioni nel suono dell'organo* suggested that rhythmically strong notes in scales should be taken with 2. One can only guess whether Frescobaldi preferred to use 3 for the strong or for the weak notes.

Fingering is discussed in sixteenth- and early-seventeenth-century Spanish treatises and prefaces. The variety of their approaches can be seen in their suggestions for scales:

Juan Bermudo, *Declaración de instrumentos musicales* (1555):
LH ascent, 4321 4321; descent, 1234;
Venegas de Henestrosa, *Libro de cifra nueva* (1557):
LH ascent, 4321 321; descent, 1234 3434; right hand (RH) descent, (5)4321 321; ascent, (12)3434;
Hernando de Cabezón, preface to Antonio de Cabezón's *Obras de musica* (1578):
RH ascent, 343434; descent, 323232; LH ascent, 4321 4321; descent, 1234 1234; and
Correa de Arauxo, *Facultád organica* (1626):
diatonic (white-key) scales, RH ascent, 3434; descent, 2323; LH ascent, 2121; descent, 3434; for "extraordinary [chromatic] runs," RH ascent 234234 or 1234 1234(5); LH ascent, 321321 or 4321 4321.

Tomás de Santa María's suggestions in his clavichord tutorial *Arte de tamer fantasia* (1565) are similar but more elaborate.

Hundreds of fingerings are preserved in late sixteenth- and early-seventeenth-century English manuscripts, but no keyboard tutorials. John Bull, William Byrd, Orlando Gibbons, Thomas Tallis, and Thomas Tomkins are among the composers represented in these manuscripts; there are also quite a few anonymous pieces with fingerings. Some particularly valuable sources are held at the British Library, London (including *My Ladye Nevell's Booke*); Royal College of Music, London; Christ Church, Oxford; University Library, Cambridge; Fitzwilliam Museum, Cambridge; and the Bibliotéque Nationale, Paris. These sources show that most English players (with the possible exception of Byrd) would consistently use 3 for the metrically strong notes in scale passages (the opposite of the German practice), except that when the LH ascended, the thumb would often take them instead (with 2 crossing over for the next note). Repeated notes were normally played with changing fingers.

Four seventeenth-century sources in German keyboard TABLATURE include: (1) a South German manuscript (Berlin, Deutsche Staatsbibliothek) that includes pieces by Sweelinck with occasional fingerings; (2) a Danish manuscript from around 1625 (Copenhagen, Royal Library), in which the RH is fingered throughout; the fingerings are generally along English lines, but occasionally are so awkward that one may wonder just how competent they are; (3) a North German manuscript from about 1640 (Wolfenbüttel, Herzögliche Bibliothek), in which all the pieces are fingered; the weak notes are routinely assigned to 3 in the LH, but the same finger is assigned to the strong notes in the RH (as if the LH were "German," the RH "English"); and (4) a manuscript (ca. 1680; Brasov [Romania], municipal library) containing J. H. Kittel's *12 Praeambula durch alle Claves auf Clavichordien und Instrument zu getrauchen*, all fingered, as well as *applicaturae* (short, fingered musical examples) by Daniel Croner.

The most important source of French Baroque organ fingerings is André Raison's *Livre d'orgue* (1680). Raison's table of ornaments includes RH fingerings: for the mordent, 323; for the trill, 4343. Another source, the preface to Guillaume-Gabriel Nivers's *Livre d'orgue* I (1665), prescribes 432 1212 1 for ascending scales in the LH, an example of paired scale-fingerings with 3 taking the strong or weak notes at will. Most existing late Baroque French fingerings are applied to harpsichord music: two tutors by Saint-Lambert (1702, 1704), Dandrieu's *Pièce de clavecin courtes et faciles* (1713), François Couperin's influential *L'art de toucher le clavecin* (1710), and three publications of Rameau (1722, 1724, 1732).

Other European sources in the 1710s and 1720s tended to add new technical devices without rejecting the old ones, yielding remarkably unsystematic fingerings that are often conditioned by the musical context. Among these are manuscripts with works by Johann Sebastian Bach, A. B. Della Ciaja, George Frideric Handel, Alessandro Scarlatti, and Domenico Zipoli. Bach is represented by a *Präludium und Fughetta* (BWV 870a), copied at Leipzig (ca. 1735) by Johann Caspar Vogler, Bach's former student and successor as organist at Weimar (Deutsche Staatsbibliothek, ms. P 1089). The *Clavierbüchlein* for Wilhelm Friedemann Bach contains fingerings in Bach's own hand for an *Applicatio* (BWV 994) and a *Praeambulum* (BWV 930; Figure 41).

Some larger pieces by J. S. Bach for organ are fingered (by someone else) in a mid-eighteenth-century manuscript in Leipzig, University Library. Some treatises and harpsichord tutors of the first half of the eighteenth century suggest unpaired scale fingerings: Jean-Philippe Rameau's *Traité de l'harmonie* (1722, for slow bass notes) and publications by Peter Prelleur (1730), Franz Anton Maichelbeck (1738), Michel Corrette (1749), Hartung (1749), and Friedrich Wilhelm Marpurg (1750).

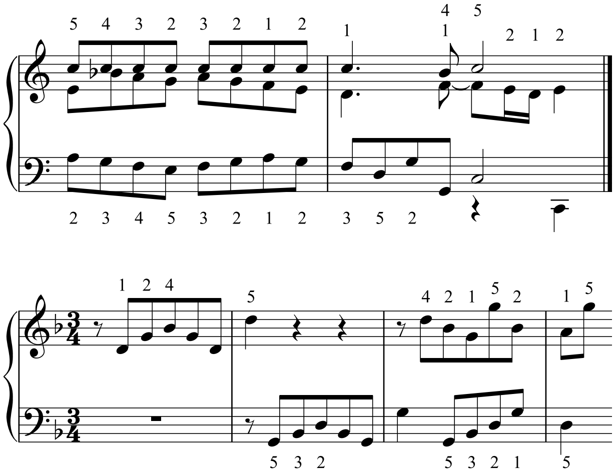

Fig. 41. J. S. Bach, Clavierbüchlein, from top: Applicatio, excerpt; Praeambulum, excerpt.

Hartung, Marpurg, and Carl Philipp Emmanuel Bach (*Versuch über die wahre Art das Clavier zu spielen* I, 1753) were among the first to give specific scale fingerings for each key. While Bach suggested alternatives for each key, many of his preferred fingerings fit his general rule: when moving away from the body (center of the keyboard), the thumb should take the note directly after a chromatic note; moving toward the body, the thumb takes the note just before a chromatic note. Thus for the LH ascending in A major he considered 21 321 432 "in most cases more useful" than 54321 321. Bach offers another technique—using the thumb between two fingers in step-wise passages, in most contexts—that contrasts with Hartung and Charles Burney (1770). Interestingly, Bach was critical of one of François Couperin's most forward-looking innovations, the use of finger substitutions to maintain continuity, calling it "extraordinary" and a difficult technique "too often, and without need." Pieces by Bach with his own fingerings are the *Achtzehn Probestück in sechs Sonaten* (H 70–75, W 633a), *VI sonatine nuove* (H 292–97, W 63b), and *Kurze und leichte Klavierstücke mit veränderten Reprisen und beygefügter Fingersetzung* (H 193–203; W 113).

Tutors for stringed keyboards were the primary sources for fingering approaches during the second half of the eighteenth century, including Marpurg (Berlin, 1755; in French, 1756), Nicolò Pasquali (Edinburgh, 1760), Georg Simon Löhlein (Leipzig, 1765; revised editions include August Eberhard Müller, 1804, and Carl Czerny, 1825), Daniel Gottlob Türk (Halle, 1789), and Muzio Clementi (London, 1800). A notable organ tutor from this period is J. H. Knech's *Vollständige Orgelschule* (Leipzig 1795–98).

Modern Editions and Studies

Among the many modern editions and studies, there are many focused specifically on fingering. Among those not listed in the bibliography here are: J. S. Shedlock's edition (1908) of Alessandro Scarlatti's toccatas; Hilda Andrews's edition (1926) of William Byrd's *My Ladye Nevell's Booke*; Gustav Leonhardt's edition (1968) of Jan pieterszoon Sweelinck's fantasias and toccatas; Kenneth Gilbert's editions of the first two books of Couperin's harpsichord music (Le Pupître, 1969–70); and Ruggiero Gerlin's edition (1943) of Alessandro Scarlatti's *Toccata primo*. Among other notable articles published on more limited topics are an article by Craig Lister on Hartung (*Early Keyboard Journal* 4, (1985-6) and Mark Lindley's article on Alessandro Scarlatti's *Toccata primo* (*Early Music* 10, 1982). Recent doctoral dissertations (some containing translations) include E. J. Soehnlein on Girolamo Diruta (University of Michigan, 1975); S. J. Schwartz on Justin Heinrich Knecht (Stanford University, 1973); E. L. Hays on Marpurg (Stanford, 1976); Newman Powell on early keyboard fingering and its effect on articulation (Stanford University, 1954); and Maria Boxall on early English keyboard techniques (Trinity College, London, 1970). Other sources are R. H. Haggh's translation of Türk's *Klavierschule* (1789) (Lincoln 1982) and Sol Babitz's articles in *Music and Letters* 43 (1962) and *Diapason* 40 (1969).

See also **Pedagogy; Performance Practice**

MARK LINDLEY

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FISK, CHARLES B(RENTON) (1925–1983)

American organbuilder. Born in Washington, D.C., on 7 February 1925, Fisk studied physics and music at Harvard and Stanford Universities. He received his training in organ building with Walter HOLTKAMP in Cleveland, and in 1955 became a partner in the AN-

DOVER Organ Company, begun in 1949 by Thomas W. Byers of Methuen, Massachusetts. In 1958 Fisk purchased Byers's interest, and in 1961 moved the company to larger quarters in Gloucester, Massachusetts.

Although the firm's earliest work included many electric action rebuilds and new organs, all Fisk organs had mechanical key action as of 1958, although some did have electric stop action. With D. A. FLENTROP as consultant, Fisk built a two-manual tracker organ, with a WERKPRINZIP case, suspended action, low wind pressure, and a Dutch-style tonal design, for Mt. Calvary, Baltimore (1961; 2/34). The firm, renamed C. B. Fisk, Inc., built its first three-manual organs for King's Chapel, Boston (1964; 3/38) and Christ Church, Westerly, Rhode Island (1965; 3/35). Fisk's first four-manual organ was completed in 1967 for Cambridge, Massachusetts, Harvard University Memorial Church (4/49). These instruments were the first large mechanical key action organs by an American builder in the twentieth century. Like all Fisk instruments, they are distinguished visually by custom-designed casework.

With the exception of the Baltimore organ, all Fisk organs built in the 1960s and early 1970s were tonally designed and voiced in an eclectic style that, while showing the influence of Fisk's impressions of the Andreas Silbermann organ at Marmoutier (France), also had strong American and English elements (Old West Church, Boston, 1970; Center Church, New Haven, Connecticut, 1971). During the 1970s Fisk made several trips abroad to study and document historic instruments in France, the Netherlands, and northern and eastern Germany. This resulted in noticeable changes in his work, both tonal (greater use of lead pipework, higher cut-ups, stops based on meas-

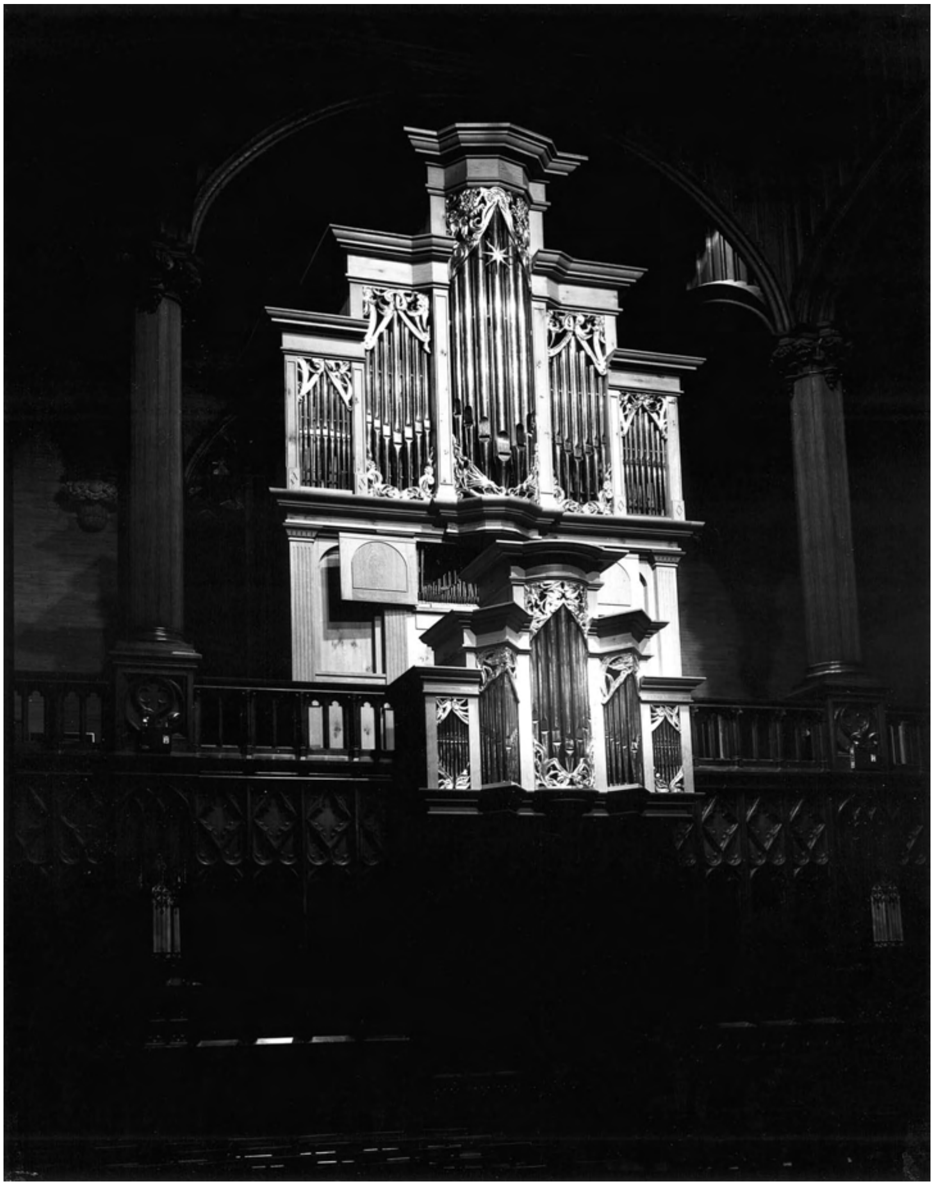

Fig. 42. Fisk organ in meantone temperament, op. 72 (3/32), Wellesley (Massachusetts) College.

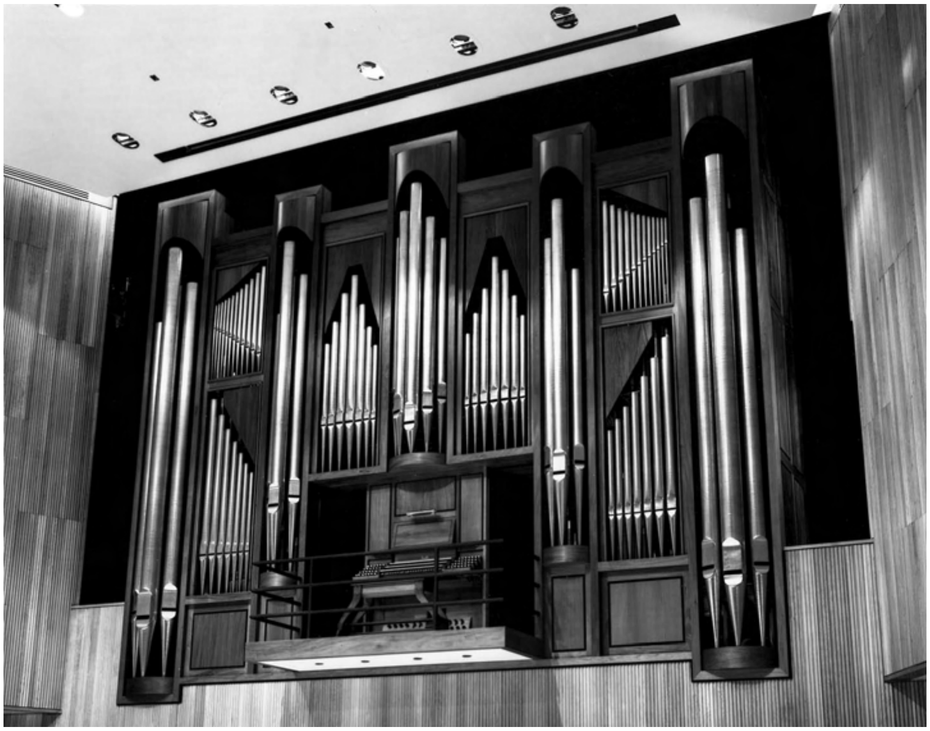

Fig. 43. Fisk organ, Op. 95 (3/47), Slee Hall, University at Buffalo, New York.

ured historic models, nonequal temperaments) and mechanical (suspended actions, more flexible winding, greater use of mechanical stop action). He paid especially close attention to the use of freer wind supplies, a concern he discussed in his classic essay, "The Organ's Breath of Life." (This and other Fisk writings are available on the Fisk website.)

While in most cases these new influences did not predominate, Fisk built some organs based closely on specific historic models, including two continuo organs based on a John Snetzler chamber organ (1972), a Cliquot-style French classical organ (Burlington, University of Vermont, 1975), and a Gottfried Silbermann–inspired organ (First Congregational, Westfield, MA, 1977). Fisk's most important and influential historically based organ was built for Wellesley (Massachusetts) College Chapel (1981; 3/30); modeled after the work of Friedrich Stellwagen, it is tuned in meantone temperament and its keyboards have two subsemitones to the octave. It uses two large wedge bellows that can be operated by hand.

At the same time, a series of sizable instruments demonstrated Fisk's new knowledge of historic practices, combined to create a wide-ranging kind of eclecticism. The first of these was a four-manual instrument for House of Hope Presbyterian, St. Paul, Minnesota (1979), which was designed to play "seventeenth-century German, eighteenth-century French, [and] nineteenth-century French" music. It has a free wind supply, tracker action with slider-chests, and shallow cases. This instrument was the model for several subsequent organs, including First Presbyterian, Charleston, West Virginia (1980), Christ United Methodist, Greensboro, North Carolina (1982) and Downtown United Presbyterian, Rochester, New York (1983). Two organs built at the end of Fisk's life display another facet of eclecticism in their combination of selected elements: Palo Alto, California, Stanford University Chapel (French classical and German Baroque), and Hadley, Massachusetts, Mt. Holyoke College Chapel (German and Italian Renaissance). Fisk's work represents the metamorphosis of the "American classic organ." He insisted upon retaining the essentials of the traditional organ, while pointing the way to versatility "dependent upon a delicate balance among all the components."

Fisk retired because of illness in 1978, and died in Boston on 16 December 1983. Since then, the business has been led by his widow Virginia Lee Fisk, and President Steven A. Dieck. Most of the larger organs follow the general pattern of those of the early 1980s. Exceptional organs of this later period include the "Marilyn Mason organ" at the University of Michigan, Ann Arbor (1985; 2/27; after G. Silbermann); Slee Hall, State University of New York–Buffalo, (1990; 3/45, first with Fisk servopneumatic lever action); Portola Valley, California, house organ (1991; 3/42, French classical/Romantic); Minato Mirai Hall, Yokohama, Japan (1998; 3/62, floating Tuba division); and the first American-built organ in a European cathedral, at Lausanne, Switzerland (2003; 5/124 ranks).

Barbara Owen

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FLAGEOLET

An open Flute stop of 2' or 1' pitch, soft and round in tone, cylindrical metal or wood pipe; effective as a solo stop or part of a flue chorus; used in northern Europe from the sixteenth century on. Not the same as the German *Flachflöte*, which is either an open metal conical stop of 8', 4', or 2' pitch, or a open cylindrical rank with a sudden taper toward the top—the so-called Spillflöte—with added ears. *Flageolet* is also a synonym for NINETEENTH/LARIGOT.

See also **Stop**

FLAT

In a case, a recessed CHEST or group of chests alternating with PEDAL TOWERS and similar structures as seen from in front. By the Renaissance, the normal pattern (outside of Italy) comprised x number of (T)owers, within which x-1 (F)lats resided; thus, TFTFT, or 3 + 2 = 5; TFTFTFT, or 4 +3 = 7; and up to 7 + 6 = 13 in very wide instruments.

See also **Case; Facade**

RICHARD KASSEL

FLAUTO D'AMORE/FLÛTE D'AMOUR

Small-scaled Flute manual stops of 8' or 4' pitch, either open or half-stopped in the Rohrflöte mold with an inserted perforated cap at the top; generally made of wood, although conical metal pipes are found. Like the alto instrument it is named after, the Flauto d'Amore is soft yet resonant; the pipe's structure favors lower partials in a manner that sounds brighter and more stringlike than expected.

FLAUTO DOLCE/FLÛTE DOUCE

A soft open Flute of 8' or 4' pitch, with narrow mouth to dampen harmonics and thus soften the tone; prevalent from the late Renaissance on. The pipe, once slightly inverted-conical in shape, is now longer inverted and is usually made of spotted metal (although wood examples exist).

See also **Dolce/Douce**

FLENTROP, D(IRK) A(NDRIES) (1910–2003)

Dutch organbuilder. Born in Zaandam, North Holland, on 1 May 1910, Flentrop became director of Flentrop Orgelbouw (founded in 1903 by his father, Hendrik Wicher Flentrop) in 1940, having studied in his father's workshop and with Theodor FROBENIUS & SONS in Denmark. Both father and son had an interest in the restoration of early instruments as well as the building of new ones; their 1936 restoration of the Christian MÜLLER organ at Beverwijk, Reformed Church (1756; 2/22/pull-down) marks one of the first attempts to return an early organ to its original condition.

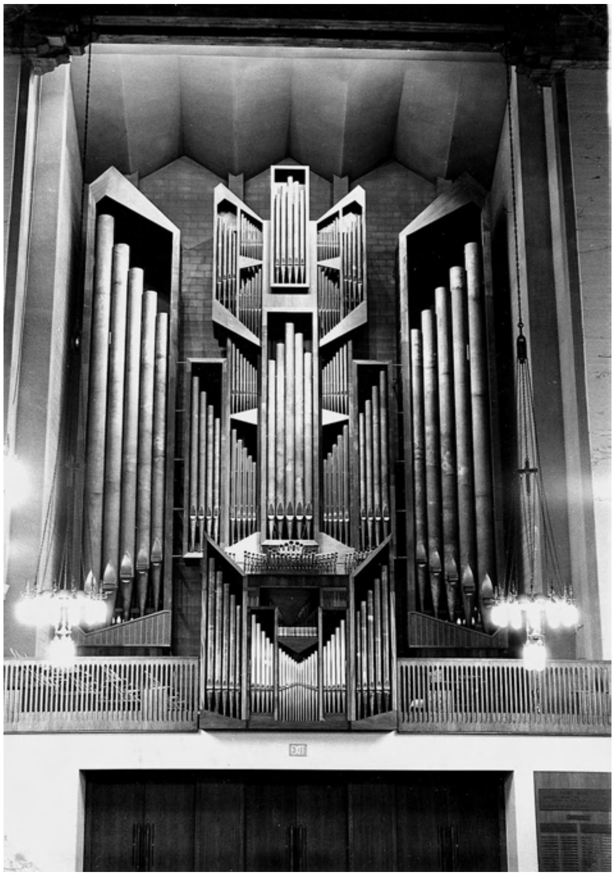

Fig. 44. Flentrop organ, 1965 (4/55), St. Mark's Episcopal Church, Seattle (Photo by William Van Pelt).

After World War II, D. A. Flentrop (as he came to be known) restored other important instruments in the Netherlands, including the large 1723 Franz Caspar SCHNITGER organ in Zwolle, Michaelskerk (1955). He continued to build new organs and became convinced that encased instruments in the traditional style, with slider-chests and mechanical action, represented the best option for organ design. His first new organ wholly in the traditional Dutch style (based on then-available knowledge) was built in 1950 for the Hervormde Kerk in Loenen aan de Vecht. It had a Hoofdwerk based on an 8' Prestant, and a disposition as follows: Hoofdwerk: Prestant 8', Roerfluit 8', Octaaf 4', Spitsquint 2-2/3', Octaaf 2', Mixtuur VI, Dulciaan, 16'; Rugwerk (Positief on the gallery rail): Gedekt 8', Prestant 4', Roerfluit 4', Gemshoorn 2', Quint 1-1/3', Scherp IV-V, Regaal 8'; Pedaal: Subbas 16', Octaaf 8', Nachthoorn 4'; plus manual and pedal unison couplers. In 1952, his organ for the Gereformeerde Kerk in Doetichem became a model for works in the traditional style: it had pedal towers, 32 stops, three manuals (Hoofdwerk 8', Rugwerk 4', Borstwerk 2'), a Pedaal (16'), and couplers; all divisions were based on Prestant stops.

Flentrop's impact on U.S. organ building was considerable; beginning with a five-stop Positief for University Presbyterian, San Antonio (1954), he built ninety-five organs throughout the country, ranging from small single-keyboard instruments to the organ in Durham, North Carolina, Duke University Chapel (1976; 4/66). Among the larger instruments built in the United States were those for the Harvard University Busch-Reisinger Museum, Cambridge, Massachusetts (1958; 3/27); Reynolda Presbyterian, Winston-Salem, North Carolina (1961; 3/30); St. Mark's Cathedral, Seattle (1965; 4/55); and Warner Hall, Conservatory, Oberlin, Ohio (1974; 3/44). Because of his experience with restorations of organs, especially in Evora, Oporto, and Coimbra, Portugal, he was commissioned to restore the two great organs in the Spanish style in the Mexico City Cathedral (probably built or rebuilt in 1735–36 by José Nasarre). This was completed after many delays in 1978, under Flentrop's supervision, even though he had officially retired in 1976. Flentrop Orgelbouw, now directed by Cees van Oostenbrugge, observed its one hundredth anniversary in 2003; D.A. Flentrop died in Santpoort, North Holland, on 30 November of that year.

Flentrop was regarded as a teacher by many players and builders, and his articulate justification for what he considered optimum design for organs was as highly regarded as was the quality of his work. Although details of some designs changed as he learned more (e.g., free wind supplies), Flentrop's basic insistence—that every part of the organ (actions, case, wind supply, disposition, visual appearance) be related so that the whole design would constitute a unit—never wavered.

JOHN T. FESPERMAN

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FLOATING DIVISION

SEE DIVISION

FLUE

(1) One of the two classifications of PIPES in the traditional organ, also called LABIAL (the other is the REED, also called LINGUAL). Although flue pipes may be made of wood or metal and there are myriad subclasses and individual types of pipes, all function like large whistles. Air is forced from the WINDCHEST past the TOE VOARD, through the toe hole, and into the pipe's FOOT; it is then directed through the mouth's lower LIP, WINDWAY, and LANGUID (called a block in a metal flue pipe) through the flue itself (see definition 2, below) to become a flat sheet of air directed toward the edge of the upper lip. At this point, a sound is generated whose pitch is largely determined by the length of the upper part of the pipe, often called the 4 (more properly applied to reed pipes). Factors such as pipe and toe hole diameter, mouth width, CUT-UP, material used, and the resonator's shape (and whether it is open, partially stopped, or completely stopped) determine dynamic level; tonal qualities depend largely on whether the fundamental or upper partials of a note are emphasized, determined to a large extent by the VOICING. That being said, the flue pipes produce sounds of a relatively uncomplicated harmonic nature: open stops (including principals, flutes, and strings), potentially sounding all overtones; and covered stops (Bourdon, Gedackt) that, like other closed pipes, emphasize odd-numbered partials.

(2) In a flue pipe, the narrow slit at the upper part of the windway between the top of the lower lip and the languid or block; the point at which the air is pressed

into the flat sheet that will strike the upper lip and produce sound. Adjustments to the flue (NICKING) have been used in varying degrees historically to voice pipes and modify timbre and loudness.

RICHARD KASSEL

FLUTE

The term *Flute* (It. Flauto; Fr. Flûte; Ger. Flöte) has two definitions: (1) originally, any pipe that did not belong to the Mixtures when the Blockwerk was divided into stops in the late medieval period; (2) one of the three major family of flue stops, along with FOUNDATION STOPS (PRINCIPAL, DIAPASON) and STRINGS. The stops, generally of wide scale, may be open, stopped, or half-stopped; made of wood or metal; and of various shapes (chimney, cylindrical, conical, flared or taped top, often, the sound of a flute stop resembles a Principal or Diapason. The Querflöte stop imitates the transverse flute, but there are numerous approaches, many involving OVERBLOWING.

FLÛTE À FUSEAU

SEE SPITZFLÖTE/SPIRE FLUTE/FLÛTE À FUSEAU

FLÛTE À PAVILLON

A stop invented in France in the 1840s and introduced into England by the French builder Ducroquet at the 1851 London Exhibition; it enjoyed popularity in England for about a half century. Its distinguishing feature is the flaring bell (*pavillon*) on the top of each pipe. These bells required extra work in the construction of the pipes and extra space on the windchest, factors which contributed to its eventual decline in usage. BISHOP and other English builders renamed the stop Bell Diapason, an inappropriate name, as it is really a Flute, or at least a Flute-Diapason hybrid. Its tone is full and rich, and some examples have a slight hornlike timbre.

See also **Stop**

EDWARD L. STAUFF

FLUTE-CLOCK

SEE MECHANICAL ORGAN

FLÛTE HARMONIQUE

SEE HARMONIC FLUTE/FLÛTE HARMONIQUE

FONDS

Term traditionally used by French composers to signify a REGISTRATION made up of “foundations,” that is, of judiciously selected PRINCIPALS and other FLUE stops at the unison pitches of 16’, 8’, and 4’, and, in the Pédale, occasionally 32’ as well. Employed now and then in organ music of the French classical period, the term acquired greater significance during the Romantic era, when it signified a basic ensemble of flue stops, to which the ANCHES (reed ensembles) were added or subtracted.

In the French classical era, *fonds* referred to a registration of Principal and Flute stops of 16’, 8’, and 4’ pitches normally associated with a specific type of piece, the *fond d’orgue*. To judge from extant examples by Jacques Boyvin, Gaspard Corrette, Nicolas de Grigny, Louis Marchand, and others, the fond d’orgue was a short work with a full, rich texture (usually four-part), intended for performance on a single manual, the GRAND ORGUE. In the preface to his *Messe du 8e ton* (1703), Corrette recommended coupling the Positif (Positiv) to the Grand Orgue and drawing the following stops for the fond d’orgue: Grand Orgue: Bourdon 16', Montre 8', Bourdon 8', Prestant 4'; Positif: Bourdon 8', Prestant 4’, or Montre 8’.

Toward the end of the French classical era, François Bédos de Celles, in *L’Art du facteur d’orgues* (1766–1778), suggested coupling the Positif with the Grand Orgue and drawing all the Montres, Bourdons, open 8’ stops, Prestants 4’, and Flutes 4’, and the Pédale foundations for the *fond d’orgue*. His recommendation for drawing Montres, Bourdons, and open 8’ stops points to a broader fonds ensemble than Corrette’s. BÉDOS DE CELLES also strongly cautioned against the use of the *tremulant doux* for the *fond d’orgue*, a practice followed by “certain disgusting organists.”

In the Romantic era, the trend toward a thicker sonority continued. The fonds registration still consisted of unison registers, at 16’, 8’ and 4’, and sometimes 32’ pitch, but it encompassed a greater number of stops. At 8’ pitch, all flues (Principals, Flutes, and strings) except the Célestes were generally included in the fonds. At 4’ pitch, the Principals were usually included, while harmonic flutes and string stops were often used as part of the anches ensemble, adding color and weight to the reeds. Which 4’ stops belonged to the fonds and which to the anches on an instrument was determined by the builder, who placed the anches of each DIVISION on a separate WINDCHEST, activated by a VENTIL. In addition, on the French Romantic organ, more manuals could be coupled into the Grand Orgue, thanks to the BARKER LEVER. This meant that the fonds stops of three or more manual divisions could be blended into one large ensemble. As important as the change in sonority was the change in purpose: the fonds combination was no longer assigned solely to the fond d'orgue; rather, the fonds served as a ubiquitous "starting" registration, a neutral canvas to which the anches could be added and subtracted to produce color and dynamic nuance.

César Franck, whose music firmly established the use of the Romantic fonds registration, commonly employed the Hautbois 8' as part of the fonds ensemble on the RÉCIT; in the case of the Aristide CAVAILLÉ-COLL organ that Franck played at Ste. Clotilde (1859), the Récit Basson-hautbois 8' rested on the fonds windchest. In the scores of his organ works, Franck normally designated the pitch of the fonds stops to be drawn (e.g., 8' registers alone, 8' and 16' registers together). He seems to have given the player latitude in the selection of specific 8' and 16' stops. In other instances, Franck called for "tous les fonds," all FOUNDATION STOPS. For the opening of his *Grande pièce symphonique* (1863), Franck indicated all 8' stops on the Grand Orgue and Positif, all 8' stops plus Hautbois on the Récit, and all 8' and 16' stops on the Pédale. He excluded the Voix céleste 8' on the Récit and three anches ensemble stops: the Octave 4' on the Grand Orgue, and the Flûtes octaviante 4' on the Récit and Positif. The Récit and Positif were coupled into the Grand Orgue, and all three were coupled into the Pédale. When Franck played on the Grand Orgue with this registration, twelve 8' stops and two 4' stops sounded. (For the complete specification of the Ste. Clotilde organ, including Franck's "tous les fonds," see ANCHES.)

The strong emphasis on doubling is analogous to the Romantic scoring of Hector Berlioz, who sought a rich sonority in his *Symphonie fantastique* (1830) by requesting a string section of "at least fifteen" first violins, "at least fifteen" second violins, "at least ten" violas, "at least eleven" cellos, and "at least nine" double basses. The instruments of Cavaillé-Coll (and, to some extent, Joseph MERKLIN) and the music of Franck firmly established the Romantic fonds combination as a basic registrational principle, one emulated by other French organbuilders and composers well into the twentieth century.

GEORGE B. STAUFFER

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FONTANES, JOAQUIM A(NTÓNIO) P(ERES) (CA. 1750–CA. 1820)

Portuguese organbuilder. He built two impressive organs for Lisbon Cathedral; one remains there, the other is now in Santa Engrácia. Smaller instruments were built for churches in Tavira, S. Tiago (1785), Lamego (1791), and Ponta Delgada (Azores), Nossa Senhora da Conceição (1797). King João V commissioned Fontanes to build six organs for the royal basilica at Mafra, Lisbon (1792–1807); the work was partly subcontracted to António MACHADO E CERVEIRA. (These organs underwent restoration between 1989 and 2002.) Fontanes's Lisbon instruments are stylistically conservative, with fifty-one-key compasses and Baroque facades. But Fontanes makes copious use of the half-stops common in later eighteenth-century Iberian instruments: typically, Principal and Eco divisions with fourteen such stops in common, including a novel treble Clarinette in both divisions, and a treble Corneto Inglesa in the Eco. His sons formed a firm, Fontanes Filho, that built an organ for Oeiras, Nossa Senhora da Purificação (1827).

Fontanes may have been descended from a family of Portuguese or Spanish builders, although this remains speculation. João Fontanes de Maqueixa (d. Mafra, 1770) probably built an instrument at Lisbon, São Vicente (1765), renovated by Machado e Cerveira (1791, 1807) and Fontanes (1807), and subsequently restored by FLENTROP (1964) and Rinolter (1994), it is in active use. Fontanes de Maqueixa also built an organ at Aveiro, Misericórdia (1767). Before that, Simão Fontanes, a Galician friar (probably from Santiago de Compostela), built instruments for Orense Cathedral, 1731–34; Braga Cathedral (Gospel side), 1737; and Braga Cathedral (Epistle side), 1738. He may have built an instrument at Amarante with his student Francisco António Solha.

RICHARD KASSEL

FOOT

SEE PITCH AND PITCH STANDARDS

FOOT

In the anthropomorphic terminology of organ pipes, the bottom section of a FLUE pipe. The foot rests on the beveled TOE BOARD hole and is held in place by the rackboard; it carries the air from the WINDCHEST. The equivalent in the REED pipe is called the BOOT. In either case, the combined assembly is attached to the RESO-

NATOR, or upper body of the pipe. (The term *resonator*, while usually applied to reed pipes only, is sometimes used for the upper part of a flue pipe.)

RICHARD KASSEL

FORK

SEE TUNING FORK

FOUNDATION STOPS

Unison and octave stops of the organ. When the first ranks were separated from the BLOCKWERK chorus, the basic sound of the organ was designated the PRINCIPAL (also called Prinzipal, Principale, PRESTANT or Praestant, Doif or Doeff, or Montre). Its flue pipes, made of lead, tin, or a mixture of the two (spotted or common metal), became emblematic not only of the organ's sound but of its appearance, with Open Diapason pipes placed on the case's facade as display pipes. Larger Principal bass pipes (16' and 32') were moved to pedal towers added to the left and right side of the central case; a small number of medieval organs of this type are preserved. Starting in the seventeenth century, the foundation stops were replaced in the facade by wooden stopped pipes in most European countries.

Other kinds of stops characteristic of foundation tone were the Quintadena and reed stops (Trombone, Fagotto). The use of Bourdon-like stops was rarely found in Italy and Spain, where wooden pipes substituted for metallic ones only in the lower octave of foundation stops. By the mid-nineteenth century, the registration was based on 8' stops, producing a more homogenous (to some, duller) tone; traditional integrated sonority gave way to solo stops and more powerful winding.

See also **Anches; Chorus Reeds; Diapason; Fonds; Registration**

MARCO TIELLA

FOUR FOOT

Reference to pipes and ranks tuned one octave above the unison EIGHT FOOT register; present from the medieval era with its smaller instruments. As with the 8' pipe, the pitch of a 4' pipe depended on length of foot, standard pitch, wind pressure, and type of pipe, scale, and flue size (prior to the trend toward standardization begun in the seventeenth century). In modern terms, c = 128Hz, but some instruments continue to be tuned according to historic pitch levels. Initially, four foot ranks were the unison register in the POSITIV or CHAIR ORGAN; in the later Werkprinzip design, 4' ranks became subsidiary to 8' ranks in larger organs, although it was present in all divisions (usually no more than two stops apiece). Among the more common 4' stops are the Principal (technically, the Octave), various flutes, and the Quintadena.

See also **Stop**

FOURNITURE/FURNITURE

SEE MIXTURE

FOWKES, BRUCE

SEE RICHARDS, FOWKES

FRAME

SEE BELLOWS; CASE

FRANCE

The organ in France today derives some elements from its native predecessors as it reveals strong links with other national traditions. Two types of French historical organs were at different times prevalent throughout France for over a century. The mechanical and tonal aspects of both types, the French classical organ and the French Romantic (symphonic) organ, are inseparably bound to the music created for them and to the composers who wrote the music. Elements of both the instruments and the music can be seen in works of the early twenty-first century.

Historically, there is evidence of organs in France during the Middle Ages, and the first publications of organ music in France date from the Renaissance, in the first half of the sixteenth century. It was not until the seventeenth century, however, that a distinctly "French" instrument appeared; previously, organs in different regions of France tended to take on the characteristics of instruments built by neighboring countries. Instruments in the south of France, for example, often resembled Italian organs, while those in the north were more like instruments in Germany or the LOW COUNTRIES.

The first description of what came to be called the French classical organ is found in Marin Mersenne's *Harmonie Universelle* (1636), which describes the instrument and its use in Paris. Through the influence of Louis XIV, and the desire of French aristocracy of the period to emulate the style of his court, the basic characteristics of instruments built throughout France evolved from the Parisian type described by Mersenne. Instruments incorporating these traits were soon found throughout all of France, and the style continued to dominate French organ building well after the death of Louis (1715). Even as late as 1770, François Bédos de Celles described an organ with essentially the same characteristics in his *L'art du facteur d'orgues*; examples still survive that were built right up to the time of the Revolution. This is the kind of instrument for which François Couperin, Louis-Claude Daquin, and Nicolas de Grigny composed.

The French classical organ was housed in two parts: the *Positif de dos* (i.e., Rückpositiv) in a case located behind the player, and the rest of the instrument in the main case, as seen in the photograph of François-Henri Cliquot's organ in the Cathedral of St. Pierre in Poitiers (1790). As with all instruments of this design, the facade pipes of the Positif (Positiv) are from the 8' Montre, while those of the main case are from the 16' Montre. The key action (*traction suspendu*, suspended action) and the arrangement of chests meant that only a rollerboard intervened between the player's finger and the pallet in the chest; this nearly direct action gave the instruments a very light and responsive touch. Couplers, when present at all, were generally limited to two: a Grand Orgue to Pédale coupler and a Positif to Grand Orgue *coupler à tiroir* (drawer coupler), which required the player to push the keyboard of the Grand Orgue forward before it could be engaged (i.e., a shove).

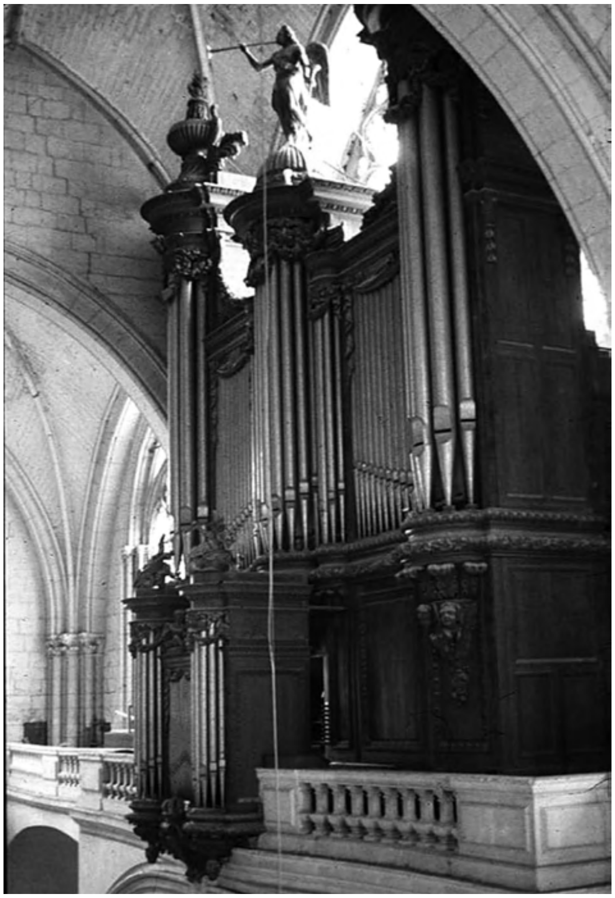

Fig. 45. François-Henri Cliquot organ, 1790 (4/44), Cathedral of St. Pierre, Poitiers, France.

The typical disposition included a full Principal chorus on Grand Orgue and Positif, with Bourdons at 16' and 4' pitches, flute-scale mutations, and reeds on both divisions. The Pédale was small, often having only an 8' Flûte and 8' Trompette. Both the Récit and Echo were short in compass, usually beginning at c' and playing only in the treble octaves, and typically had only a few stops. The multiplicity of Cornets is a noteworthy characteristic of these organs, and the placement of each within the case contributes to the sound palette composers found so useful in these organs. The Cornet of the Grand Orgue was typically mounted (i.e., placed on a subsidiary chest above the main chest); the Cornet of the Récit was placed in a similar position, separated from the rest of the pipes (*séparé*). The Echo division was placed below the massive windchest of the Grand Orgue, *en fenêtre* ("in the window"), behind the inset portion of the case that included the keyboards and music desk; this Cornet had a muffled, distant sound. On the other hand, the Cornet of the Positif (e.g., the five stops comprising the Jeu de Tierce) had a more immediate sound because of its placement in that division's case, closer to the listener.

The French classical organ was not, in truth, totally unchanged from 1650 until the Revolution, but these characteristics form the core of this type of organ, and can be found in French organs throughout the seventeenth and eighteenth centuries. They are evident in a late form in the Cliquot organ at St. Pierre, Poitiers (1791); nevertheless, this instrument exhibits some new characteristics within its overall structure that would not have been found earlier: the Second Huits Pieds on both Grand Orgue and Positif, and the Trompettes on both Positif and Echo. Even more notable is the appearance of the Plein Jeu, a compound stop meant to serve as a combination of the earlier Fourniture (Mixture) and Cymbale (Cymbal) pair. Bédos de Celles advocated the use of this mixture, and it is found only on late French classical organs. Here is the specification for the Cliquot organ at Poitiers:

Grand Orgue (Manual II. C-c")

Montre	16
Bourdon	16
Montre	8
Second Huit Pieds	8
Bourdon	8
Prestant	4
Grande Tierce	3 1/5
Nasard	2 2/3
Doublette	2

Quarte de Nasard	2
Tierce	1 3/5
Fourniture	V
Cymbale	III
Grand Cornet	V
1ère Trompette	8
2e Trompette	8
Voix Humaine	8
1ère Clairon	4
2e Clairon	4

Pédale (C-c")	
Flûte	16
Flûte	8
Flûte	4
Bombarde	16
Trompette	8
Clairon	4

Positif (Manual I. C-c")	
Montre	8
Second Huit Pieds	8
Bourdon	8
Prestant	4
Nasard	2 2/3
Doublette	2
Tierce	1 3/5
Plein jeu	VII
Grand Cornet	V
Trompette	8
Cromorne	8
Clairon	4

Récit (Manual III. g-c")	
Flûte	8
Cornet	V
Trompette	8
Hautbois	8

Echo (Manual IV. g-c")	
Bourdon	8
Flûte	8
Trompette	8

Coupler: Positif to Grand Orgue

The French Romantic organ developed after the Revolution and is largely connected with the efforts of a single builder, Aristide Cavaillé-Coll. His importance in relation to the instrument that became as standardized and widespread as the French classical organ had been was the result of several factors. Perhaps most important, he employed the best new technologies available, especially pneumatic power in the form of the Barker lever, and expanded the system of ventils to shut off wind to certain stops after they were drawn. He then developed these mechanical elements in such a way as to allow him to reach his artistic goals. He also modified the tonal palette of existing instruments in a uniform and carefully crafted way, such as expanding the compass of the Récit and placing it within a Swell enclosure (*Récit expressif*). Through his astute business practices and the support of influential friends and associates, he became the most sought-after builder in Europe, and more than a century after his death, his instruments remain among the most important nineteenth-century monuments to the art of organ building.

Although Cavaillé-Coll built many famous instruments, one that is particularly interesting to organists today is the one built for Ste. Clotilde in Paris (1859), the instrument associated with the music and playing of César Franck:

Grand Orgue (GO; Manual I. C-f´´´)	
Montre	16
Bourdon	16
Montre	8
Flûte harmonique	8
Bourdon	8
Viole de gambe	8
Prestant	4
*Octave	4
*Quinte	2 2/3
*Doublette	2
*Plein jeu VII	2
*Bombarde	16
*Trompette8	
*Clairon	4

Récit expressif (REC; Manual III. C-f´´´)	
Flûte harmonique	8
Bourdon	8
Viole de gambe	8
Voix céleste	8
*Flûte octaviante	4
*Octavin	2
*Trompette	8
Basson-Hautbois	8
Voix humaine	8
*Clairon	4

Positif (POS; Manual II. C-f´´´)	
Bourdon	16
Montre	8
Flûte harmonique	8
Bourdon	8
Viole de gambe	8
Unda Maris	8
Prestant	4
*Flûte octaviante	4

*Quinte	2 2/3
*Doublette	2

*Plein-jeu harmonique III-VI	
*Trompette	8
*Clarinette	8
*Clairon	4

Pédale (C-d´)	
Soubasse	32
Contrebasse	16
Basse	8
Octave	4
*Bombarde	16
*Basson	16
*Trompette	8
*Clairon	4

*jeux de combinaison (stops affected by ventils)
Pédales de combinaison:
Pédale d'orage (later Tirasse REC)
Tirasses GO, POS
Anches Pédale
Octaves graves GO-GO, POS-POS, REC-POS
Anches GO, POS, REC
Copula POS-GO, REC-POS
Tremolo REC
Expression REC

Its original stoplist contains the essential outlines of a Cavaillé-Coll organ, with only a few modifications required by the peculiarities of the building: four unison foundations stops (Montre, Bourdon, Flûte Harmonique, and Gambe) and a trumpet on each manual division; a Grand Orgue with a Principal chorus (including the Plein jeu), a 4' Flûte, and additional Trumpet-type reeds at 16' and 8' pitches; a Positif that balanced the Grand Orgue, with a secondary chorus, Flutes, and an 8' Clarinette (a descendent of the Cromorne); a Récit containing Harmonic Flutes at 4' and 2' pitches, an 8' Hautbois and a Voix Humaine; Principal choruses only on the Grand Orgue and Positif; a well-defined set of reed ensembles, or ANCHES; and a Pédale larger than that of the French classical organ, yet seldom containing anything other than 16' and 8' foundations and reeds. The multiple mutations of the French classical organ, though present in some of his early instruments, gradually disappeared from his dispositions.

One characteristic that made this tightly constructed disposition so useful to nineteenth-century composers was the rearrangement of manual order. By moving the Grand Orgue to the bottom manual, using a standard set of couplers, and employing Barker levers so that coupled manuals would be easy to play in spite of higher wind pressure, he made it possible for the player to produce a gradual crescendo. The player started by (1) playing on the Récit first, usually with reeds drawn and the box closed, then (2) moved to the Positif foundations (with the Récit coupled), then (3) to the FONDS of the Grand Orgue (with both Récit and Positif coupled). The player then (4) opened the Récit shades (enclosures), (5) added the reeds of the Positif, and finally (6) added the reeds of the Grand Orgue and Pédale to complete the crescendo. This effect can be found in the music of César Franck, Charles-Marie Widor, Marcel Dupré, Charles Tournemire, Jean Langlais, Maurice Duruflé, Olivier Messiaen, and virtually every other composer of French organ music since 1850.

The twentieth century saw the gradual incorporation of foreign elements into existing instruments, both classical and Romantic, especially in the gradual introduction of electric actions and related mechanical changes. During the middle third of the century, efforts at reform caused some Romantic instruments to be modified, as mutations were reintroduced into stoplists that had never had them—the mirror image of the way nineteenth-century "improvements" resulted in the loss of mutations in many older instruments. After the move to revise earlier instruments had run its course, serious efforts at restoration and conservation resulted in a renewed interest in both the classical and the Romantic organ. Several "historically informed" organs have been built incorporating the dispositions and technologies of the past, one notable example being the BOISSEAU-Cattiaux French classical organ built in 1995 and housed in the early eighteenth-century case in the chapel at Versailles. Many newer instruments, especially those by Bernard AUBERTIN and Mühleisen, may be described as "pan-European" both in their incorporation of both earlier and modern technologies and in their dispositions that include elements from both France and other traditions.

See also **Alsace**

James H. Cook

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FREE REED

A pipe with a freely vibrating tongue (reed) that does not strike a shallot to produce its sound (as with the lingual reed). Instead, the tongue vibrates within a frame to which it is fixed, motivated by air from the windchest to oscillate rapidly within the frame. This oscillation in turn pressures the air in the resonator to produces sound at the top of the pipe. To succeed, the space between the reed and the frame has to be very narrow. Reeds and frames are usually made of brass, although in some instruments steel or iron is used for the reeds, and aluminum for the frames.

Some scholars attribute the invention of free-reed organ pipes to the Italian instrument maker Filippo Testa (ca. 1700); there is even a suggestion of the use of this kind of reed by Michael PRAETORIUS (1619). The first definitive source dates from 1781 when the German physicist and mathematician Christian Gottlieb KRATZENSTEIN published a detailed description of the acoustical properties and the construction of organ pipes with free reeds. This new type of pipe had tuning-clips and could be easily integrated in the instrument. The principle was so successful that, to this day, little has changed from Kratzenstein's original model. He was helped in inventing the free-reed pipe by the Czech organbuilder Franz Kirschnik (Krisnik; ca. 1741–ca. 1801); but Kratzenstein's interest was in inventing a "speaking machine."

There is no support for the idea that Europe's free reeds were inspired by the Asian free-reed MOUTH ORGAN (*khène*, *shêng*), although these instruments were in European collections from the early seventeenth century (see Mersenne). The reeds are totally different, not only in construction—the Asian reed being cut directly from the frame, forming a part of it and resting on the same level, the European being separate from the frame, fixed upon it and lying above the frame's level—but also in acoustic principles.

Use of free-reed pipes revealed two unique qualities. Pitch wasn't affected by changes in WIND PRESSURE, especially in the treble and middle registers; these reeds could therefore produce a crescendo and decrescendo, making these organ stops "expressive." Also, free reeds did not require the usual pipe or resonator, but could be fixed on wooden resonating chambers or individual cells. This made it possible to build smaller instruments, ranging from the harmonica to the concertina and accordion.

The first organbuilder to incorporate the new pipes into combination instruments and special organ models was Georg Joseph VOGLER, who was inspired by a Kirschnik instrument to build a small organ, named the ORCHESTRION. With this instrument he traveled from the mid-1780s throughout Europe, spreading the gospel of the free-reed pipes.

The first organbuilder to use a free-reed stop in a church organ seems to be Georg Christoffer Rackwitz (1760–1844) in Stockholm (1780s). In 1795 Christian Erdmann Kindt (Stralsund; b. 1752) put a "Clarionett" into the organ at Sagard/Rügen, said to have been based on "a new invention"—probably free reeds (the stop and its pipes are lost). The impulse to create a REED ORGAN fully capable of expression was realized with the invention of the *orgue expressif* by Gabriel-Joseph GRENIÉ. He combined lingual stops with free-reed stops, but every reed was integrated in a separate boot and had its own resonator. The first organlike instrument with pipeless reeds fixed on a single resonating chamber was the *poïkilorgue* of Aristide CAVAILLÉ-COLL, developed in the 1830s. Alexandre-François DEBAIN developed the harmonium, patented in 1842. In 1821, the Austrian Anton Haeckl named his free-reed organ the "physharmonica"; in Germany the instrument invented in the 1810s by Bernhard Eschenbach (1769–1852) and Johann Caspar Schlimbach (1777–1861) was called the "aeoline."

During the nineteenth century organ stops with free reeds were used, especially in German-speaking countries: the favorite stops were the Clarinet 8' (an effective orchestral stop), Aeoline 8', and Fagott/Basson 16'. Pedal stops were often built with free reeds, such as the Bombarde or Posaune 16' or 32' (4' was found occasionally). E. F. WALCKER often used an Oboe 8' with free reeds, placing it on a separate chest with a special swell device (Stephansdom, Vienna, 1886). Organ stops with free reeds, like those with striking reeds, have resonators of different sizes and shapes to produce various sounds, but normally have longer boots than other reed pipes. The length of the resonator must be calculated carefully, otherwise the sound will deteriorate and eventually stop altogether.

After 1900, free reeds became obsolete in the church and concert hall organ, but as late as 1914 Schiedmayer and Weigle, Stuttgart, created the "Parabrahmorgel," combining a pipe organ (including high pressure stops) with a Schiedmayer harmonium of the compression (pressure) type, supplemented by a special expression device to modify the wind pressure by a pedal (one survives in Eichwalde near Berlin; rest. 2002). By the 1920s, free reeds had been replaced by striking reeds. It is only in the 1990s that organbuilders revived clarinet stops with free reeds (Klais; Cologne, Ruhr University, Bochum, 1998).

German organbuilders constructed pipeless stops (the so-call Physharmonika) after the Western equivalent of the mouth organ. When incorporated into church organs, these stops were placed on a separate windchest, with a separate crescendo pedal. Common in smaller village organs, the Physharmonika proved ironically problematic by virtue of its resistance to differences of temperature and humidity; as the other pipes shifted their tuning naturally, the inflexible Physharmonika became "out of tune" with the other stops. Special tuning devices (tuning-clips and long wires, moved by a hammer) for every reed allowed them to be tuned as needed; but the stop had to be located above the keyboard, and frequent tuning tended to damage the tuning-clips and wires. Some of these stops have survived and a few of them have been restored (Schramberg/Württemberg; Walcker, 1835). The sound of Physharmonika stops is soft and harmonica-like, ordinary in timbre but distinguishable within a wide dynamic range.

Christian Ahrens

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FRELS, RUBIN S(TEELE) (B. 1928)

American organbuilder. Frels, born in Victoria, Texas, on 17 November 1928, graduated from Principia College, Elgin, Illinois. He established Rubin S. Frels Pipe Organs in his hometown in 1951. Employing only a few workers, he built mechanical action organs, mostly in Texas, often rebuilding older instruments or using the pipes from them. Among his larger installations are Fort Worth, Holy Family Catholic, (1971; 3/44) and Laredo, Blessed Sacrament Catholic (1985; 3/53). Frels was also engaged in restoring organs in Mexico, including the four-manual Austin now at Puebla Cathedral.

Arthur Lawrence

FRENCH HORN

An 8' reed stop, imitating the orchestral instrument of the same name; specifically, the stopped or muted sound created when the hornist puts a hand in the instrument's bell. (The term *Waldhorn*, "forest horn," is reserved for the open horn sound.) Used primarily as a solo stop, its wide-flared, capped inverted-conical pipe has an inharmonic initial sound that simulates the hornist's attack; this, along with a strong, brasslike emphasis on the lower partials and dampened upper partials, and a smooth tone, make the French Horn an especially successful imitative stop.

See also **Stop**

FREYTAG, HEINRICH HERMANN (1759–1811)

Dutch builder of German birth. Freytag, born in Hamburg around 15 April 1759, was the son of a Württemberg cabinet maker. He went to work for Albert Antoni Hinsz in Groningen shortly before the latter's death (1785). Hinsz's stepson, Franz Caspar Schnitger, Jr. (1724–1799), inherited the business and began a partnership with Freytag. Their first work was a 4' organ for the local Mennonite church (1785) that resembled a Hinsz Rugwerk. They repaired an instrument designed by Arp Schnitger in 1719 for Zwolle Cathedral (1787); enlarged a Hinsz at Kampen, Bovenkerk (1788–90); and rebuilt the organ at Het Zandt, Mariakerk (1791; 2/12/pull-down; extant). Schnitger and Freytag built new instruments in Bierum (1792), with unusual facades for the Hoofdwerk and a quasi-Onderpositief; Zuidhorn (1793); Zuidbroek, Reformed/Petruskerk (1794–95; realization of Hinsz contract); and Bellingwolde (1796–98; two manuals, pull-down, separate “roof” over the Vox Humana).

After Schnitger’s death, Freytag began working outside Groningen, rebuilding the organ for Enkhuizen, Zuiderkerk (1799; 2/20; rest. Flentrop, 1992). He built a new organ for Baarn, Kasteel Groeneveld (ca. 1805; 1/6/no ped; now Doesburg, Martinikerk) and worked on instruments for Rotterdam, Laurenskerk (1806–07) and Finsterwolde, Reformed (1808). In 1809, Freytag made significant renovations to Arp Schnitger’s 1696 organ at Noordbroek, Reformed; after several restorations, the organ remains a beautiful and playable instrument, with most of Freytag’s changes retained. In the year of his death (Groningen, 11 Apr 1811), Freytag took on two commissions he would not live to complete: Oostwold, Reformed, (2/18/pull-down, extant) and Warffum, Reformed (extant, now 2/24). Both were finished by his student Johan Wilhelm Timpe (1770–1837). Freytag’s son Herman Eberhardt Freytag (1796–1869) continued the business, retiring and selling the firm in 1862.

Freytag’s instruments (ten survive) preserve much of Schnitger’s refined sound, as opposed to the more robust tone of Hinsz. He brought Germanic qualities to the strong French character of the Dutch organ of the day, while maintaining Schnitger’s high building standards. Freytag modernized winding, pipe-making, and case design. His 1808 organ at Finsterwolde, with its truly singing character, incorporates three 16′ stops in its single manual. His 1811 two-manual design for Oostwold gives a disposition ideal for congregational accompaniment, with its Trompet and Dulciaan 8′ stops and the first Dutch use of the Carillon stop, as a plenum or bells.

RICHARD KASSEL

FRIDERICI

SEE SAXONY

FRIEDERICHS (FRIEDRICHS), JOHANN CASPAR (1762–1825)

German-Dutch organbuilder. Friederichs was born in Wickrath, Lower Rhine, on 22 June 1762. He came to the Netherlands as a furnituremaker and worked in HENDRIK HERMANUS HESS’s shop in Gouda, where he was married in 1783. After Hess’s death in 1794, Friederichs took over some of the firm’s maintenance contracts. A cabinet organ by Friederichs dated 1798 closely resembles Hess’s work in this field. Between 1805 and 1825, Friederichs maintained the famous Christian MÜLLER organ at Haarlem, St. Bavo’s. This led to commissions from other churches in that city. In 1806 Friederichs added a new Bovenwerk to the 1770 J. H. H. BÄTZ organ in the Doopgezinde Kerk (now Oostvorne, Dorpskerk). The new division was built in a swell box, according to Friederichs the first one ever produced in the Netherlands.

In 1808, Friederichs built a new organ for the Waalse (Walloon) Kerk, using some pipes of the Van Giesen organ (1730). Apart from some minor alterations, the organ has been preserved very well and bears witness to Friederich’s high level of craftsmanship, while the extraordinary fine woodcarving details betray its maker’s background. Another surviving instrument by Friederichs is at Neerlangbroek, Dorpskerk (1809). In 1823, two years before his death on 15 January 1825, Friederichs built a large organ for the Zuiderkerk in Amsterdam. This organ contained many pipes from the former small organ of that city’s Oude Kerk (Schonat, 1658). The instrument’s remarkable facade was designed by Jan de Greef; unfortunately, the facade was destroyed in 1939, the Schonat pipework eventually ending up in the 1977 METZLER organ in Oegstgeest, Groene Kerk.

JAN-PIET KNIJFF

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FRISIA

SEE EMS-DOLLART REGION; LOW COUNTRIES

FRITTS, PAUL

American organbuilder. Paul Bayard Fritts’s career began in 1966, when he began working for his father’s small organ workshop in Tacoma, Washington (established 1970). Instruments built until 1980 were electric action, with pipes imported from the Netherlands. From 1980 through 1986 a partnership was formed with

Ralph Richards under the name Fritts-Richards Organ Builders, which built only mechanical action organs (eight instruments). During this period a pipemaking operation was established and the shop enlarged. In 1986 Richards left to form RICHARDS, FOWKES AND CO. with Bruce Fowkes in Ooltewah, Tennessee.

Since that time, Fritts has built organs under the name Paul Fritts and Co., Organ Builders, and the shop has been enlarged to accommodate the setting-up of large instruments. They manufacture virtually every component within the organs, including all pipes, key actions, windchests, bellows, and casework. By 2002 the company employed seven craftspersons, including Fritts's sister Jude, responsible for design and carving of the custom pipe shades. All tonal, mechanical, and architectural design and voicing is under the direct control of Paul Fritts. As a builder he has described the goal of his instruments as "historically inspired organs conceived for the artistic and liturgical needs of the client." Including the instruments from Fritts-Richards, twenty-four mechanical action organs have been built under Fritts's direction, with four more instruments under contract.

Fritts's instruments include: Shelton, Washington, Methodist (1979; 2/16); Seattle, St. Alphonsus (1985; 2/33); San Diego, All Souls' Episcopal (1986; 3/34); Tacoma, Washington, University of Puget Sound (1989, 2/34); Tempe, Arizona State University (1991; 2/29); Tacoma, Pacific Lutheran University (1997; 3/54); and Princeton, New Jersey, Theological Seminary (2000; 2/39).

DAVID DAHL

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FRITZSCHE, GOTTFRIED (1578–1638)

German organbuilder. One of the most significant figures of his era, Fritzsche remains a model for builders. Fritzsche (Fritch, Fritz) was born in Meissen, Saxony, near Dresden. His association with the Saxon court helped his reputation as an important builder in central Germany. When he moved to Hamburg in 1629, he contributed greatly to the development of the North German organ, leading directly to the work of Arp SCHNITGER. Fritzsche was friend and colleague to many leading organists and composers of the day, including Jacob Praetorius, Michael PRAETORIUS, Heinrich Scheidemann, Samuel Scheidt, Melchior Schildt, and Heinrich Schütz. Information about Fritzsche organs is not complete; specifications of many Fritzsche organs are lost, and what does exist is sometimes contradictory in detail from one source to another. Significant information comes from Praetorius's *Syntagma musicum* II along with other sources.

Fritzsche built several large organs with the support of wealthy court treasuries, and thus he could realize in his instruments unusual, even lavish ideas in visual and tonal design. Only one instrument is known to survive: a three-stop positive with hardened paper pipes (1627), now housed in the Victoria and Albert Museum, London; its date and origination (it has a portrait of the Saxon Elector Johann Georg I) weighs in favor of an attribution to Fritzsche, and it may have been a gift to English royalty. Of the surviving pipes, an inventory prior to the restoration of the organ in Hamburg, St. John's (1636) listed surviving pipes, including some made by Fritzsche.

Fritzsche's metal pipes were of the best quality, containing a high percentage of tin within the case as well as for the prospect or facade pipes. He hammered the metal pipes and used a process of sandcasting the pipe metal. Wooden pipes were used in Fritzsche organs, both for Flutes and as a secondary Principal stop at 8' pitch, undoubtedly of smaller scale than the primary Principal 8'. Examples of a wooden Principal stop were found in Dresden (court chapel, 1614), Sondershausen (Trinitaskirche, 1615), Schönigen, (court chapel, 1617); and Hamburg (Maria-Magdalena Kirche, 1630). Fritzsche's stoplists indicate use of such "novelty stops" as Vogelgesang, Trommel or Heerpauken, Cymbelstern, Triangle, and a cuckoo stop. Tremulants appear in some stoplists for an entire organ, in other instances limited to a single division. The presence of both fast and slow tremulants on one organ is found at Sondershausen.

The surviving descriptions of Fritzsche cases and facade displays indicate that he created splendid and opulent instruments where money was available to do so. Three instruments from his Dresden period (1614–29) are reported by Praetorius as having, within each of three facade chests, three ranks of gilded Principal and reed pipes. These were the instruments in the court chapels of Dresden and Schönigen as well as the city church of Bayreuth (1618). Another luxury was Fritzsche's use of SUBSEMITONES, or divided sharp keys, in one or more divisions of his instruments, documented in the three early Dresden organs; Sondershausen; Braunschweig, Ulricikirche (1626); and three Hamburg churches: Mary Magdalene; St. John, and St. Peter.

In at least a few instances Fritzsche built one stop with two drawstops, making it available to manual or pedal independently by transmission. Transmission on organs where finances were apparently not an issue (Schönigen, Sondershausen) might indicate that space and chest design were considerations in choosing to utilize transmission. The use of transmission between manual and pedal was practiced by other builders, including the COMPENIUS family during the seventeenth and eighteenth centuries. Couplers between manual and pedal were provided on most of the Fritzsche organ designs, but evidence is limited.

Among Fritzsche's most important works are: Meissen Cathedral (1603; with Rückpositiv; destr. 1638); Dresden, court chapel (1614; 3/33; his first large new organ, designed by Hassler); Freiberg, Petrikirche (reb. 1614; new Rückpositiv, etc.); Sondershausen, Trinitaskirche (1615; 3/33, pedal towers; destr. 1621); Schönigen, court chapel (1617; 3/23); 1618 Bayreuth, Stadtkirche (1618; 3/35, short octave; inaugurated by Scheidt with M. Praetorius, Schütz in attendance); Wolfenbüttel, Hauptkirche Beatae Virginiae (1623; 3/36); Braunschweig, Ulricikirche (1626; 3/25, Pedal with two mixture stops; twenty-six-note pedalboard, spring-chest); Hamburg, Maria-Magdalena Kirche (1630; 2/23, one-third reed stops; inspected by Scheidemann and J. Praetorius); Torgau, Schlosskapelle (1631; commissioned by Schütz); Hamburg, Katharinenkirche (1634; added seven-stop Brustwerk); and Hamburg, Jacobikirche, his last major work (reb. 1636; enlarged to four manuals, added 10 stops; new spring-chest).

Followers of Fritzsche include his son Hans Christoph Fritzsche, whose son-in-law, Hans CAHMAN, is identified with Swedish organ building; Friedrich STELLWAGEN of Lübeck, Fritzsche's son-in-law and an important influence in his own right; Joachim Appeldohrn, Hamburg; Constantius Ibach, Stade; Jonas Weigel, Braunschweig; and Tobias Weller. Aspects of Fritzsche's organ building not only helped shape seventeenth- and eighteenth-century organ building in North Germany; they continued to influence within the context of the early twentieth-century ORGAN REFORM MOVEMENT, with its strong emphasis on North German organs. In the second half of the twentieth century a number of highly regarded organbuilders have turned to historic models for inspiration, giving attention to all aspects of construction and voicing, aiming for a of re-creation of both the spirit and the art of organ building of Fritzsche and his contemporaries.

DELORES BRUCH

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FROBENIUS, THEODOR (AND SONS)

Danish organ-building firm. In 1909 the immigrant German organbuilder Theodor Frobenius (b. Weikersheim, Baden-Württemburg, 7 Oct 1885; d. Copenhagen, 16 Mar 1972) established an organ-building firm in Copenhagen. Because of his eminent talents as an artist and craftsman he soon made a name for himself in church circles. In 1916 he attracted considerable attention with his advanced electro-pneumatic instrument for Jerusalem Church, Copenhagen. In 1925 the firm moved to Kongens Lyngby, where it is still housed. In the same year a Jutland branch was opened in Horsens.

Frobenius had been an apprentice for August LAUKHUFF in Weikersheim, and he had grown up in the late Romantic organ-building era, but when the epoch-making ideas of the ORGAN REFORM MOVEMENT reached Denmark, he was soon convinced of its values and executed an about-face. In 1944, when his sons Walther Frobenius (b. 1920) and Erik Frobenius (1926–2002) entered the business, the firm was already building organs according to classical principles, with mechanical action and slider-chests. During the following years the Frobenius firm was actively developing and refining its renowned NEOCLASSICAL ORGAN, characterized by functional design and distinctively bright and lean sound.

A fruitful collaboration with Albert SCHWEITZER (mainly represented by Swiss engineer Ernst Schiess) led to the monumental instruments of Roskilde Cathedral (1926) and Århus Cathedral (1929), both reusing older facades and organ stops. After 1934 the firm had a further successful collaboration with the German organ theoretican Hans Henny JAHNN, then living in exile in Denmark.

Important recent organs built in Denmark include those at Næstved, St. Morten's (1975), Horsens, Our Saviour's (1977), Vangede (1979), Albertslund, Church of the Resurrection (1991) and Vester Skerninge (2002). Instruments built abroad include Queen's College Chapel, Oxford (1965), Mahikari Grand Shrine, Takayama, Japan (1984), Marienfelde Kirche, Berlin (1994), United Methodist, Saratoga Springs, New York (1996), and Canongate Kirk, Edinburgh (1998).

OLE OLESEN

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FUGARA

A string stop dating from the seventeenth century and popular among German builders. It is made of open metal or wood pipes, sometimes tapered, and is usually found at 4' pitch, though 8' examples are not uncommon. Authorities differ in describing its tone, variously describing it as a string/reed hybrid, a string/horn hybrid, cutting, hornlike, soft, loud, and indefinite. The name derives from Slavic words for a shepherd's pipe. *See also* **Stop**

EDWARD L. STAUFF

FÜGLISTER, HANS J. (B. 1930)

Swiss organbuilder. Born in Zurich on 18 April 1930, Füglister, after training with METZLER, completed his studies with Rudolf von BECKERATH in Hamburg, and then Troels Krohn in Hillerød, Denmark (Füglister married his daughter). Studies with Gaston Litaize in Paris expanded his knowledge of organ literature.

In 1960 Füglister founded his own organ-building business in Grimisuat/Sion, in Valais (Wallis) Canton, Switzerland's most important area for historical organs. From the very beginning, interest centered both on building new organs and carefully restoring historical instruments, and the firm has now completed over two hundred new or restored organs. Perhaps the crowning achievement in its restoration work is the world's oldest playable organ in Notre Dame de Valère, Sion (ca. 1435).

Being fully equipped, including a pipemaking shop for metal and wooden pipes, the workshop craftsmen build all the necessary components of a pipe organ. Though the instruments always employ mechanical action, larger instruments utilize electric combination action to facilitate the numerous registration changes required in Romantic literature. His daughter, Annette Füglister (b. Sierre, Wallis, 25 May 1970), is now active in the firm.

Instruments (all are in Switzerland) include: Reckingen, Village Church (rest. ca. 1746 organ; 1975); Münster, Village Church (rest. 1680 Aeby organ; 1980; 2/20); Basel, Marienkirche (1988; 3/42); Gossau (rest. late-nineteenth-century Lombard organ; 1992; moved from Vacallo, Ticino, 1969); Brig, Kollegiumkirche (1994; 3/40) 1994; and Biel, Église du Pasquart (2001; 4/40).

DOUGLAS E. BUSH

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FÜHRER

German organ-building firm. Alfred Führer (1905–1974) learned organ building with Furtwängler and HAMMER; thereafter he worked in Switzerland and in the United States. In 1933, despite widespread economic problems and cultural changes, he started up his own business in Wilhelmshaven. He recognized the beginning of stylistic change early and built mechanical slider-chest organs, influenced by his encounter with historical organs. Exemplary restorations brought him a good reputation and, in the 1950s, a rapid increase in contracts. He was a founding member of the International Society of Organbuilders in 1957.

In 1951 his nephew Fritz Schild (b. 1933) trained at the workshop, then worked with D. A. FLENTROP, ROETHINGER, and Walter HOLTKAMP. He returned to the firm in 1960; after his uncle died, he became manager and, with his uncle's widow Liddy Führer

(1906–2001), directed the company. He left his mark on the workshop's new approach while continuing to pursue Führer's vision. He retired in 2000, and the firm was taken over by Heiko Lorenz (b. 1959), who learned with Arno Voigt and was honored with the Arp Schnitger Prize. The company, which had built or restored almost one thousand organs, closed at the beginning of 2004. Among its last instruments are: Seoul (1993; 3/44); Munich-Laim (1994; 3/41); Diersbach, Austria (1995; II/25); Oepping, Austria (1999; 2/22); Mühlheim/Ruhr (2000; 2/30); Tromso, Norway (2001; 2/22); and Bodo, Norway (2003; 2/26).

Christoph Keggenhoff

FULGENZI, VINCENZO (FL. 1578-1600)

South Netherlandish builder, active in Italy. His documented name takes several forms; references to "Quemar" are few and inexplicable. He has also been misidentified with Vincenzo Beltramo Borgognone, who held a 1544 contract for an organ at Totoreto, S. Nicolò.

Fulgenzi is known to have built two organs: one for Gubbio, S. Pietro Cathedral (1578-98), the other for Orvieto Cathedral (1591–1600). The Gubbio organ, lauded by Girolamo Diruta (*Il Transilvano dialogo sopra il vero modo di sonar Organi*, 1609) as "extraordinary," was even more highly praised by Adriano Banchieri in his *Conclusioni nel suono dell'organo* (1609), calling it "un organo stupendissimo." According to Banchieri, its ripieno had twelve registers, suggesting Principale stops as high as a Quadragesima (Fortieth, 1/6') or Quadragesima Terza (Forty-third, 1/8'). He then lists the color stops: covered, open, spitz, and conical Flutes; Piffaro, a reed imitating a tranverse flute; Tromboni, Trombe, Voce umana, Cornetto, and Viole; and "accessories" such as Ciamballetti (Zimbelstern), Usignuolo (Nightingale), and Tremulant. The Orvieto organ, according to the 1591 contract quoted by Banchieri, was to have a similar group of Flutes (including a 2-2/3' Flauto Coperto and 1-1/3' Flauto à Fuso) plus Cuckoo, Usignuolo, Cornamusa, and cricket stops.

Fulgenzi is credited with having introduced a number of the aforementioned stops to central Italy (Umbria). Banchieri was especially impressed by the naturalness of the imitative stops. Not all observers were so positive; Barcotto cites the Orvieto organ specifically in criticizing imitations of "trombones, bassoons, cornets, human voices, and other *galanterie* . . . in compliance with the whims of those who would spend money on such stops." Banchieri also credited Fulgenzi with introducing Italy to the Rückpositiv, played independently of the main organ or by a single player as a department on the main organ.

Richard Kassel

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FULLER, ALFRED (1845–1923)

English-born Australian organbuilder. Born in Kelvedon, Essex, on 2 October 1845, Fuller was associated with the noted London organbuilder George Maydwell Holdich, who influenced his later organ-building style. After working in the United States, Fuller arrived in Melbourne in 1872; he built his first Australian organ in time for the 1880 Melbourne Exhibition (3/33, Barker lever action, first 16' reed made in Victoria; moved to Toorak Presbyterian, Victoria). Fuller opened a factory in the Melbourne suburb of Kew, where he built more than twenty-five instruments. He was George Fincham's chief rival in the later years of the nineteenth century and built instruments for clients in Victoria, Queensland, and Western Australia. Fuller became an estate agent following his retirement from active organ building in 1900; he died in Moonee Ponds, a suburb of Melbourne, on 10 June 1923.

Fuller's instruments were lavishly made from first-class materials and incorporated excellent casework of original design, with richly decorated facade pipes. The organs are indicative of his earlier experience in the United States. Consoles were impeccably detailed with precious timbers and splendidly crafted music racks, key cheeks, stop jambs, and wind indicators behind glass. His metal pipework was invariably imported from England and was more generously scaled and of thicker gauge than that of his rival Fincham, producing a broader, symphonic tonal quality. The tonal design of his instruments emphasised unison sounds rather than upper work and often introduced exotic registers, such as the Cone Gamba, Flageolette, Keraulophon, Clarionet Flute, Concert Flute, Harmonic Piccolo, and Corno di Bassetto. In this way Fuller introduced the first elements of the Romantic (symphonic) style into Australian organ building.

Other notable instruments (all in Victoria) included Bendigo, St. Paul's Anglican (1883; 2/22); East Melbourne, Cairns Memorial Presbyterian (1884; 2/22); Melbourne, Baptist, Collins Street (1885; 3/32); North Fitzroy, St. Brigid's Catholic (1886; 2/16); North Melbourne, Methodist (1886–87; 2/20); and Ballarat, Independent Church (1888; 2/17).

JOHN MAIDMENT

FULL ORGAN

SEE PLENUM

FUNDAMENTUM ORGANISANDI

A manuscript of pieces for the beginning organist by Conrad Paumann (ca. 1410–ca. 1473), a multi-instrumentalist and town organist of Nürnberg who became court organist to the Munich court in 1450. The *Fundamentum organisandi magistri Conradi Paumanns ceci de Nürenberga anno 1452* (to give its full title) and other works had to be dictated by Paumann, as he was blind; a few of his pupils, including his son Paul Paumann (d. 1517), have been identified. The *Fundamentum* is not a textbook but a progression of cantus firmus compositions for improvising, composing, and making ornamented variations of bass parts, progressing by seconds, thirds, fourths, fifths, and sixths. The last pieces are in three parts and are fully composed, mature works, not just demonstrations of improvisational formulas for the discant (melody) parts; there are no "rules" per se. The musical examples given can be used both in church and as secular music. The music in the *Fundamentum* is notated on seven lines; the bass is given in letters. This so-called German TABLATURE was invented by Paumann, at least according to Sebastian VIRDUNG in his *Musica getutscht* (1511).

The Buxheimer Orgelbuch, an anonymous collection from later in the century, contains in large part works by Paumann and his south German contemporaries. It can be seen as a continuation of the *Fundamentum*, which would have been assembled for Paumann's Nürnberg pupils, while the pieces in the Buxheim manuscript reflect his pedagogy in in Munich. There are some concordances (shared works) between the two; the notation, however, uses slightly different symbols and so there is some debate as to whether Paumann contributed personally to the Buxheim manuscript.

FERDINAND J. DE HEN

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FURTWÄNGLER

SEE GIESECKE AND SOHN; HAMMER ORGELBAU

G

GABLER, JOSEPH (1700–1771)

German organbuilder. Born in Ochsenhausen, Swabia, Gabler worked from 1717 or 1718 in Mainz in the woodcarving shop of Anton Ziegenhorn and his son Johann Eberhard. Gabler may have studied organ building with Hans Jakob Dahm, Ziegenhorn's brother-in-law Johann Peter Geissel, or Anton Ignaz Will. After the deaths of Anton (1720) and Johann Eberhard (1726) Ziegenhorn, Gabler took over the shop and married the younger Ziegenhorn's widow (1729).

Returning to Ochsenhausen, he began building the organ of the Weingarten Basilica, St. Martinus (1737–50; rest. Kuhn, 1981–83). The Rococo case was designed by Gabler himself, creating a synthesis with the church's architecture (e.g., having six windows visible within the case); to Williams it recalls a southern European grotto organ. However, it is the complex nature of the technology behind the windchest and action system that make this organ exceptional. Located in the church's west end, the organ's sixty-three stops are allotted among four manuals—Hauptwerk, Oberwerk (incorporating a Kronpositiv above it), Unterwerk, and a Rückpositiv located on the same plane as and to the south of the main case—and a Pedal consisting of one division in the main case and a second Rückpositiv division, located to the north of the main chest and mirroring the manual Rückpositiv. The two pedal towers are on the same vertical plane as the Rückpositivs. This symmetrical but unusual layout requires a detached console to support the wingchest-like design. There are ten stops with doubled ranks and an emphasis on aliquot color stops and complex mixtures, but only a single independent Nasat 2-2/3' on the Oberwerk—a proto-Romantic stoplist that anticipates the emphasis on 8' stops. Gabler's choir organ in the same church (1739–42; case and facade pipes extant) confirms this emphasis.

Along with Karl Joseph Riepp, Gabler was the most important organbuilder in Swabia at the time. He built thirteen organs, ranging from one to four manuals; some were destroyed during the nineteenth century. His other surviving works are his first organ at Ochsenhausen (1728–34; orig. four manuals, now 3/49) and the instrument at Memmingen, Maria-Steinbach (1755–59; thirteen of orig. twenty-four stops were 8'). As the Weingarten organ demonstrates, Gabler's craftsmanship in wood- and metalwork was second only to Gottfried Silbermann. He was less strong in the areas of pipe scaling and design of the wind supply (particularly at Weingarten). Gabler had a few pupils who became famous in their own right: Martin von Hayningen, Johann Nepomuk Holzhay, and Jozef Höss.

Tina Frühauf

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GAMBA

An nonimitative String stop of 16' or 8' (manuals or pedal) or 32' (pedal), wood or metal, clear and brilliant, but not pungent; effective in Principal as well as solo use.

See also **Stop**

GARNIER, MARC (B. 1947)

French organbuilder. Born in Belfort on 14 July 1947, Garnier was apprenticed to Curt Schwenkedel in Strasbourg (1965–69). He finished his training in Germany with Rudolf von BECKERATH and harpsichord builder Rainer Schutze. He opened his own workshop in 1972, first at Barr (Alsace), then at Morteau (Franche-Comte).

Under the influence of Klaas Bolt and Harald Vogel, his earlier instruments display an historical orientation, leaning toward North European Baroque. He revived the old German spring-chest, which he used in almost all instruments. His first church organ, Strasbourg, St.-Paul (choir, 1976; 2/13), demonstrates the use of these techniques, with a spring-chest, a short octave, pipework of hammered lead, and cuneiform bellows; it was the first new twentieth-century organ of the twentieth century to use mesotonic tuning: all pure thirds (5:4), with two optional supplementary notes per octave. Other important instruments are at Metz Cathedral, a Renaissance-style organ built inside a 1537 case (1981; 2/10); Esquelbecq, with double semitone and sharp keys (1982; 2/25); and the Protestant church at Belfort (1983; 2/24), built in the North German style with pedaled turrets.

Garnier's first French classical organ was his first Japanese commission: Kobe, Shoin University in Kobe (1983; 4/33). Continuing to build in Japan, his style shifted from historical to a more personal direction. The organ at Tokyo, St.-Luc Hospital (1988; 3/31) was followed by the highly innovative instrument at the Tokyo Metropolitan Art Space (1991; 8/126). Built on three revolving decks, with historical and contemporary cases, it is, in fact, three independent instruments in the same organ chests, each with a different pitch and tuning: a Dutch Renaissance organ (twenty-six stops) and a German Baroque organ (thirty-seven stops), both played from the three-manual historical console, and a classical French organ with a Romantic extension (sixty-three stops), played from the five-manual contemporary console. Despite the complexity, tracker action and spring-driven windchests are used.

Subsequent, simplified interpretations of the same style may be found at Tokyo, Christian Institute (1995; 3/31); Morioka, Civil Hall (1998; 3/34), and Tokyo, Geijutsu Kaigaku (1999; 4 + 1/76). Garnier has also built organs with more contemporary cases in Germany (Kirchheim/Teck, Tübingen, and Waldshut).

CHRISTIAN LUTZ

Translated by Moira Tierney

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GARTNER

Bohemian organ-building family. Egidius Gartner I (b. ca. 1678; d. Tachau [now Tachov, Czech Rep], 26 June 1762) was an organbuilder and baker. Little is known of his life, but he may have entered organ building through the influence of Franz Dollhopf (d. 1763), another Tachauer who became organist of the Kreuzherrenkirche St. Franziskus in Prague. Among Gartner's known instruments are those in Vidice (1727), Neugedein (Kydne, 1731), Bärnau, Germany (1735), Dubeè, Erzengel Michael (1738), and Bernatice nad Odru, Moravia (1744–45).

His son Johann Anton Gartner (b. Tachau, 5 Aug 1707; d. 11 July 1771) was also an organbuilder and baker. He probably trained with Heinrich Rabenstein in Plan (Planá) near Marienbad. Beginning in 1748 he worked independently, then went to Prague to study further with Johann Ferdinand Schwabl (1751–54); at the end of his study, Schwabl issued him a highly complimentary master craftsman's certificate. In 1764 Johann Anton is listed as a lay assessor and member of the Paulaner-Brüderschaft of the Heiligen monastery near Tachau. Among the organs he built are those in Tachau, Franziskanerkirche (1751; 2/21), Nectiny (1752; 2/15), Tepl (Teplá), Premonstratensian monastery (1754–56; 3/34; extant), Prague, St. Vitus's Cathedral (1762–65; 3/40; case extant), and Kdyne (Neugedein), St. Nikolaus (1763; 2/15). A July 1754 contract for an organ to be built for Tepl was also signed by his brother (Johann) Egidius Gartner II (b. ca. 1723; d. 27 June 1787), who helped build that instrument.

Franz Adam Gartner (b. 18 Apr 1739; d. after 1785), son of Johann Anton Gartner, was an organbuilder in Tachau. Some of his instruments include: Prague, Franziskanerkirche (1766), Vejprnice, St. Adalbert (1760s; 2/13), Radonice nad Ohrí, Marienkirche (after 1772; 2/14), and Schossenreith (Cástkov; 1779–84). Vinzenz Gartner (b. Tauchau, 11 Jan 1748; d. there, 25 June 1820), another son of Johann Anton, built the instrument at Schlaggenwald (Horní Slavkov, 1783; 2/14) with Franz Adam. Vinzenz built organs for Neuhaus, Franziskanerkirche (1780), Neuhaus, Propsteikirche (1784; 2/16), Tachau, St. Maria Magdalena (1789), Neudorf near Petschau (1805), and Horní Blatná, positive (1814). Johann Nikolaus Gartner (b. Tachau, 6 Dec 1764; d. there, 16 May 1840), son of (Johann) Egidius Gartner II, built an organ for Grafenried (Oberpfalz; 1789–91) Joseph Gartner I (b. Tachau, 28 May 1769; d. there, 8 Apr 1845), son of Franz Adam Gartner, was unable to travel and worked primarily in the shop, but he held a privilege to be the resident organbuilder for the Tepl monastery church. His brother Egidius Gartner III (b. Tachau, 24 Dec 1783) built an organ in 1808 for Železná Ruda. Joseph Gartner II (b. 11 May 1778; d. 24 Nov 1832), son of Vinzenz Gartner, also was active as an organbuilder. Franz Gartner (b. Tachau, 7 Aug 1783; d. there, 3 Dec 1841), another son of Vinzenz, eventually took over his father's workshop, but never went beyond building small village organs.

Joseph Gartner III (b. Tachau, 29 Aug 1796; d. Prague, 30 May 1863), son of Joseph Gartner I, worked in Prague with Caspar Schmidl until 1819. In 1820 he moved the Tachau workshop to Prague, where he became a citizen and organ and fortepiano builder to the court. In 1832 he published his treatise on organ technology, *Kurze Belehrung über die innere Einrichtung der Orgeln* (translated and published in Czech in 1834). He was well known for his restoration work on large Baroque organs, such as St. Mary's (1825) and St. Nicholas Kleinseite (1835), both in Prague. One singular "restoration," to Prague, St. Nicolas (1834–35), removed the elements of simplification and resultant tones that Georg Joseph Vogler had incorporated in his 1802 rebuild of the instrument. An example of Joseph III's own work survives in Preštice, near Pilsen (Plzen; 2/16). He died childless; the business was taken over by Karl Schiffner (1836–1894).

The work of the Gartner family comprises an important part of Bohemian organ building, though it is sometimes difficult to pinpoint which family member built a particular instrument. In the smaller organs of Johann Anton one sees a very traditional approach, while the larger organs incorporated reeds and rather full Pedal divisions, including mixtures. He used narrow-scaled mutations and was fond of mixtures containing tierces. Joseph III, who held the organs of Gottfried Silbermann in high esteem, wrote in his treatise of then-new trends to enlarge the keyboard compass to fifty-four notes, build a two-octave, fully chromatic pedal, and use equal temperament; his overall tonal philosophy was rather conservative.

Douglas E. Bush

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GÄRTNER, GOTTLIEB FRIEDRICH (1822–1878)

German-American organbuilder. Born in Botnang, Württemberg, on 8 May 1822, Gärtner apprenticed with E. F. Walcker at Ludwigsburg. In 1854 he went to Stettin (now Szczecin, Poland) as superintendent of Bernhard Grüneberg Company. In 1867 he immigrated to Ann Arbor, Michigan, advertising as a builder of organs and harmoniums. Among his employees were his son-in-law, David Allmendinger, founder of Ann Arbor Organ Company (which built a few pipe organs along with many reed organs), and William Schuelke, later a prominent builder in Milwaukee, Wisconsin.

After selling tools to his son-in-law in 1871 he worked briefly for Albert Charles Gemunder in Columbus, Ohio. Gärtner moved to Erie, Pennsylvania, and worked as shop foreman and head tuner for Derrick and Felgemaker until his death on 6 September 1878.

Elizabeth Towne Schmitt

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GAUNTLETT, H(ENRY) J(OHN) (CA. 1805–1876)

English organist, organ designer, composer, and critic. He was the son of Henry Gauntlett (1762–1833), evangelical divine and hymn writer. Baptized at Wellington, Shropshire, on 9 July 1805, Gauntlett played the organ in his father's church at Olney, Buckinghamshire, from the age of nine on. Although the organist of St. Paul's Cathedral (Attwood) had offered to take him as a pupil, Gauntlett was articled to a London solicitor in 1826 and, five years later, qualified as a solicitor himself. In 1827 he was appointed organist of St. Olave's, Tooley Street, Southwark, adding the post of evening organist of Christ Church, Newgate Street, London (1836). He had lessons from Samuel Wesley, through whom Gauntlett presumably discovered the organ music of Johann Sebastian Bach, of whom he soon became one of the leading English exponents. Later, he met Felix Mendelssohn, who applauded his efforts to reform English organ design ("but for him . . . I should have had no organ to play upon") and selected him to play the organ part in the premiere of *Elijah* at the Birmingham Festival (1846).

Gauntlett's crusade to reform organ design began with the reconstruction of the Newgate Street, London, organ in 1838. The work was undertaken by William Hill, and inaugurated a partnership that would transform the character of the English organ within a decade. Keyboard compasses were regularized so that each began at 8' C (now c'); flue choruses were expanded to include subunisons, Quint, and Tierce mutations, and multiranked mixtures; and "German" Pedal divisions, with twenty-seven- or twenty-nine-note compasses, a flue chorus, and reeds became standard features of larger instruments. Swell departments became fully fledged secondary divisions, with complete flue choruses and several reeds. Gauntlett persuaded Hill to pioneer the introduction of novel flute, reed, and string registers inspired by (but not dependent upon) those found in German and French organs.

Hill and Gauntlett's collaboration produced at least twenty-one organs between 1838 and 1846. The list includes St. Luke, Cheetham Hill, Manchester, and St. Peter Cornhill, London (both 1840), Great George Street Chapel, Liverpool (1841; 3/49), Worcester Cathedral (1842), Birmingham Town Hall (reconstr. 1843), and totally enclosed organs for Stanwix (1841) and All Saints, Gordon Square, London (1846). Although most of Gauntlett's work was with Hill, he also collaborated occasionally with other builders, including H. C. Lincoln at St. Olave, Southwark (1844–46), for which he designed a twenty-seven-stop, 32' Great Organ.

After 1846 Gauntlett largely withdrew from advising on organ matters, although he took out a patent in 1852 for the application of electricity to organ actions; his proposal that the directors of the Crystal Palace Company should commission facsimiles of eight of the most celebrated European organs and connect them electrically to consoles in the center of the Palace was turned down.

Gauntlett was influential as a music critic, hymnologist, composer ("Irby," "St. Albinus"), and advocate of Gregorian psalmody. He died on 21 February 1876.

Nicholas J. Thistlethwaite

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GEDECKT

A covered (Ger. *gedeckt*; also Gedakt, Gedackt, Gedact) manual or pedal Flute stop of 32', 16', 8', 4', or (rarely) 2' pitch, made of rectangular cut wood or (for the upper registers) open or capped metal, medium scale; a lower cut-up emphasizes the twelfth above the fundamental (third harmonic). Its smooth, rounded tone makes it ideal for binding together disparate stops in any division (i.e., functioning as a Copula); it can cover overly prominent partials in other sonorities and to offer a quiet counterpoint to brighter stops. It is a common, if not the most common, covered Flute stop. Spanish builders used the term *Flautado de Violon* for the Gedeckt in the seventeenth and eighteenth centuries. The term applies to a variety of stops, including Bass, Doppel, Echo, Flute, Pommer, and Regal, several harmonic stops (Quinte, Tierce, Twelfth), and a host of types described by shape or timbral analogy; the most common of the latter is the Lieblichgedeckt, smoother and softer than its less "lovely" cousin.

See also **Copula; Stop**

Richard Kassel

GEIB, JOHN (JOHANN) (1744–1818)

German-born American organbuilder. His brother Johann Georg Geib (1739–1818) was a builder who may have apprenticed at the Stumm workshop; he was joined and eventually succeeded by Johann Georg Geib II (1772–1849). John (Johann), born in Standerheim on 27 February 1744, emigrated to England about 1760 and worked successfully as an organ-, harpsichord-, and pianomaker in London until 1797. The case of an organ he built for St. Mary's, Stafford (1790), survives, now housing a later instrument. In 1797, Geib went to Philadelphia; a year later he was in New York. In December 1798, he announced the completion of his first American organ, for [Christ] German Lutheran, New York.

Although no complete list of Geib's work is known, a partial list may be reconstructed from notices and church records, resulting in the earliest substantial documentation for a New York builder. Other Geib organs include Christ Episcopal, New York (1801); St. George's Episcopal, New York (1802); St. Paul's Episcopal, New York (1802); [Benevolent] Congregational, Providence, Rhode Island (1803); Central Moravian, Bethlehem, Pennsylvania (1806); North Church, Salem, Massachusetts (1808); Grace Episcopal, New York (1811); First Presbyterian, Baltimore (1811); Second Street Reformed, Baltimore (1811); and First Moravian, New York (1815). Except for the 1802 case at St. Paul's Episcopal, none of Geib's American work is known to have survived.

Extant stoplists of Geib's organs are typical of the period in England and America. Great choruses were built on open and stopped Diapasons and contained octave, twelfth, and fifteenth ranks, capped by a divided Tierce mixture and Trumpet. Swell divisions were small: open and stopped unisons, octave, and reed, plus a solo Flute at 4' pitch, and occasionally a second solo reed or fifteenth. Only the Bethlehem organ is documented as having had PULL-DOWN pedals, although others could have been similarly equipped. The St. George's organ, a large instrument according to Geib's press notices (no stoplist has turned up), may have had an independent Pedal rank.

Geib seems to have withdrawn from organ building after 1815; he died in New York on 18 Oct 1818. He did not have apprentices who became significant builders to pass on his style. Geib's sons apparently gave up building organs in favor of importing English chamber instruments. Geib was soon supplanted as New York's preeminent builder by Thomas S. Hall.

JOHN K. OGASAPIAN

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GEIGEN/VIOLIN DIAPASON

Smaller-scaled, open metal Diapason stop, 16' or 8' (manuals or pedal), 32' (pedal); first found in German Baroque instruments, very popular throughout Europe from the nineteenth century on. A Foundation hybrid stop with a louder if not brighter sound, it blends well with flue and reed stops and is commonly used in mixture and mutation ranks. While most experts consider the Violin Diapason identical to this stop, Irwin claims the Violin Diapason (8' manuals, 16' pedals) to have a greater range of harmonics and to sound more incisively stringlike.

See also **Stop**

GEMSHORN

From the early sixteenth century, a conical metal Flute stop, wide and with a sharp tapering at the top, ranging in rank from 16' to 1-1/3' (Praetorius, *Syntagma musicum* II, 1619). The sweet, hollow mixture of flute and string tone was meant to imitate the closed-end fipple flute of the same name (Ger., "ram's horn"). By the nineteenth century, the Gemshorn had become a foundation stop of similar but narrower construction (metal, occasionally wood), pitched at 32' (pedal) and 16', 8', or 4' (manuals and pedal), clean and somewhat neutral in tone (partials from the twelfth on up are dampened, while the fifth, seventh, and ninth are stimulated). It is effective in binding other stops and reinforcing their weaker lower harmonics, and is common in mixture and mutation ranks; while not an effective solo stop, it supplies a bass without a booming fundamental and a good accompaniment to Diapason solos.

GEORGIUS (FL. CA. 826)

The first identified organbuilder in the Western world after the fall of Rome, Georgius was a Venetian priest commissioned by the Emperor Louis the Pious to build an organ at Aix-la-Chapelle (Aachen) in the year 826. It is not known where he learned the craft of organ building; Venice was a dependency of Constantinople in the ninth century, so he may have learned the Byzantine style firsthand in that city. But both Eginhard and Fulda report that Georgius constructed a HYDRAULUS, rather than the BELLOWS organ of the Byzantines. He might therefore have learned about organ building directly from a Greek scientific treatise, such as Hero of Alexandria's *Pneumatics*. It is not known whether Georgius's reputation motivated the emperor to summon him to Aix or whether he volunteered his services to build the organ. In any event, he was eagerly received by Louis, who commanded that he be given everything necessary to construct the instrument. Georgius's organ was a source of great prestige for the Frankish court, as documented in the laudatory poems of Ermold le Noir and Walahfrid Strabo. Caffi postulates that a Venetian priest, Georgio, built the organ of Grado (Venetian lagoon) in the ninth century. This "most excellent and marvelous" instrument was destroyed in the pillage of the patriarch of Aquileia in 1022.

KIMBERLY MARSHALL

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GERMANY

SEE BAVARIA; EAST PRUSSIA; EMS-DOLLART REGION; SAXONY; SILESIA; THURINGIA

GERN, AUGUST (1837–1907)

German-born organbuilder, active in France and Britain. Gern, who was born and studied organ building in Berlin, worked for Aristide CAVAILLÉ-COLL as his foreman from 1860 until 1866, after which he settled in London. The National Pipe Organ Register in Cambridge lists 101 organs built by Gern, many no longer in existence. Two of his organs survive in Glasgow. One instrument, rebuilt by NORMAN AND BEARD (1913), is in the former Westbourne Church building, now Struther's Memorial Pentecostal Church. The other organ is at the Royal Scottish Academy of Music and Drama (RSAMD), Renfrew Street; it was originally housed in the Athenium at St. George's Place. That Gern organ, donated by Walter McFarlane, was "revised and restored" by HILL, NORMAN AND BEARD in 1953.

JOHN POWER

GESELLSCHAFT DER ORGELFREUNDE (GDO)

(Ger., Society of Friends of the Organ) An organization formed at the 1951 Oberschwäbischen Barock-, Sing- und Orgeltage in Ochsenhausen, Germany. The interested parties were inspired by a presentation of organ pictures, facsimiles, and prints; an exhibition of small organs; study trips to regional historic organs of Joseph GABLER, Karl Joseph RIEPP, and Johann Nepomuk HOLZHAY; performances ranging from the seventeenth to the twentieth centuries; and lectures on different regions of Germany and neighboring countries. The members modeled their organization after France's Association des Amis de l'Orgue. The first conference took place in 1953 in Ingolstadt, a year before Walter Supper was elected chairman. He held this position until 1973, when he was succeeded by Wolfgang Adelung (followed by Alfred Reichling in 1983 and Wolfgang Baumgratz in 1998).

The GdO publications include the periodical *Ars organi* (since 1953), the *Orgelspiegel* (a list of new organs), and *Acta organologica*, a collection of scientific articles. Today the GdO has more than six thousand members in forty-eight countries, and it supports work with organs from every period. In working groups, courses, and educational trips, but especially through its annual conference, the GdO concerns itself with organ making, organ music, organ playing, historical research, and the preservation of historical organs.

SEE ALSO **ORGANIZATIONS**

CHRISTOPH KEGGENHOFF

Bibliography

Gesellschaft der Orgelfreunde. <http://www.gdo.de>.

GIENGENER ORGELMANUFAKTUR GEBR. LINK

SEE LINK ORGELBAU

GIESECKE AND SON

German pipemaking firm. In 1844 Carl Giesecke (1812–1888) established an organ workshop in Göttingen, where he built more than fifty new organs. The high quality of his organ reeds encouraged other builders to ask him to manufacture reeds for their own organs. Giesecke's son Hermann Giesecke (1847–1928) was also very talented in making reeds. The demand grew to the point that, from around 1880 on, they stopped building their organs to focus on reed manufacture. In 1912 Wilhelm Furtwängler (1875–1959), son of the organbuilder of that same name, succeeded Hermann Giesecke. Under his leadership the manufacturing of reeds was expanded and flue pipes were added to its production (ca. 1925). Wilhelm's son Philipp Furtwängler (1905–1946) joined the firm in 1930 and managed it from 1940 until he was killed in an accident. After an interim period Hans Wolf Knaths (1913–1984), who had married Philipp's widow, managed the firm until his death. Since 1984 Philipp's son Klaus Wilhelm Furtwängler (b. 1936) has run the company. He studied with Alfred Führer from 1955, worked with Kuhn, Steinmeyer, and Holtkamp, and started with Giesecke in 1963. His son Peter Philipp Furtwängler (b. 1966) studied with Bosch, worked with Klais, Eisenbarth, and Holtkamp, and joined his father's firm in 1995. The firm today employs over thirty-five workers who produce historic reed and flue as well as free-reed stops.

Christoph Keggenhoff

GLATTER-GÖTZ

German organ-building firm. Josef von Glatter-Götz (1914–1989) had run Rieger Orgelbau from 1920 on in Jägerndorf, Austria (now Krnov, Czech Rep); after the war, he relocated that firm to Schwarzach, Austria. Caspar von Glatter-Götz (b. 1945) trained in his father's firm; after his apprenticeship, he worked with Rudolf von Beckerath and Kuhn until his return to Rieger in 1969. Caspar von Glatter-Götz and Heinz Kremnitzer (b. 1964) worked there until 1993, when they established Glatter-Götz Orgelbau in Owingen.

The firm has focused its efforts on the creation of contemporary pipe organs with the assistance of a professional design architect. The construction of each organ is based on traditional principles, while the casework and decor are often innovative. The fresh visual appearance is reflected in the sound, specification, and voicing, which aim to make possible performance of a wide range of music styles. Another area of development is the building of pipe organs as freestanding or suspended sculptures for public display.

Among Glatter-Götz's instruments are: Dornbirn, Austria (1995; 2/20); Claremont, California, United Church of Christ (1998; 3/54); Palos Verdes, Califonia, United Church of Christ (1999; 3/31); Paterno, Italy (2000; 2/18); and Los Angeles, Walt Disney Hall (2004; collab. M. J. Rosales; 4/73). Current projects include Moscow, International House of Music (begun 2004; collab. Klais; 4/83) and Baton Rouge, Louisiana State University (design in progress 2005; collab. Rosales; 4/61).

Christoph Keggenhoff

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GLOCKENSPIEL

A percussion stop with a tone resembling the orchestral instrument. It is formed of dish-shaped bells, spiral rods, bars, or tubes made from steel, copper or bronze, and struck by hammers actuated by a pneumatic or electric mechanism. It is usually of short compass. Ernest M. Skinner made it with resonators, and considered it synonymous with the Celesta as well as the Harp (pitched an octave higher). It dates from the early 1700s. On theater organs the Glockenspiel sounds a single stroke each time a key is pressed; Bells is the same stop with a reiterating action.

The term *Glockenspiel* is also used for a mixture stop of from two to six ranks, intended to imitate or suggest the sounds of bells. It usually contains one or more third-sounding ranks, voiced somewhat prominently.

See also **Stop**

Edward L. Stauff

GLOWINSKI, JAN (CA. 1645–CA. 1712)

Organbuilder active in Krakow and southeast Poland. Glowinski's Baroque organs are comparable to those of the best German and Austrian organbuilders of his time. His best-known instrument was built for Leżajsk (1680–93; 2/40), with its exceptionally rich carvings. His earliest preserved organ is at Stary Sacz monastic church (1679; 1/10). After completing the Leżajsk organ he built another large instrument for the Franciscan friars in Krakow (1700–04) and at the parochial church in Zywiec (1712; 2/30).

Jerzy Golos

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GOETZE AND GWYNN

British organ-building firm. Martin Goetze worked with Grant, Degens And Bradbeer in Northampton (from 1971 on) and with Gabriel Kney in London, Ontario. Dominic Gwynn started organ building with Hendrik ten Bruggencate in Northampton in 1976. Goetze and Gwynn formed their firm in 1980, located first in Northampton, then in Welbeck near Worksop, on the northern edge of Sherwood Forest (from 1985). A third partner, Edward Bennett, joined the firm in 1985.

Goetze and Gwynn have been at the forefront of restoring historic instruments, notably British organs of the seventeenth and eighteenth centuries: Edith

Weston, St. Mary's(1787 S. Green chamber organ; 1981); Vermillion, South Dakota, Shrine to Music Museum (1786 J. Looser house organ; 1988); London, Rotherhithe, St. Mary's (1765 J. Byfield II organ; 1991); Windsor Castle (ca. 1740 C. Clay clockwork barrel organ; with Handel tunes, 1994); Hatchlands, Cobbe Collection (1759 J. Snetzler chamber organ; 1996); Cardiff, National Museum of Wales (1774 Snetzler/1864 Gray and Davison organ; 1996); Worksop, St. Anne (1852/1878 Gray and Davison organ; 3/30; 1999); London, St. Botolph Aldersgate (1791 Green/1867 Speechly organ; 2/22; 2000); Bermondsey, St. James (1829 J. C. Bishop organ; 3/29; 2002); Stanford-on-Avon, St. Nicholas (1630 R. Dallam organ; 2002; orig. Oxford, Magdalen College); and Thornage, All Saints (1812 T. Elliot chamber organ; 2003). The firm also participated in the Early English Organ Project, reconstructing two (ca. 1530) organs of five and seven stops each (2001–2).

Goetze and Gwynn has recently ventured outside the United Kingdom, repairing the anonymous English chamber organ (1/11 half-stops/no ped; 2002) at Smithfield, Virginia, St. Luke, considered the oldest organ in the United States (but not the earliest built there). In 2004, the firm worked on the late-seventeenth-century Machado organ for the Poor Clares in Santiago de Compostela, Spain. The firm publishes "Harley Monographs," reports on its restoration projects (see Goetze and Gwynn).

Goetze and Gwynn first built small instruments for early music ensembles and music departments. They began building new church organs in the mid-1980s, principally using historic instruments or styles as models, among them Richard Bridge (Vancouver, 1986; The Hague, 1987; Marldon near Paignton, 1989; Yonago, Japan, 1993) and Bernard Smith or his nephew Gerard Smith (Sheffield, 1992; Edgware, partial restoration of a 1716 G. Smith, 1994; Rehringhausen, Germany, 1997; Cambridge, Magdalene College, 2000; St. Endellion, Cornwall, Collegiate Church, 2001).

RICHARD KASSEL

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GOLL ORGELBAU

SEE SWITZERLAND

GONZALEZ, VICTOR (1877–1956)

Spanish-born French organbuilder. Founder of the firm Etablissements Gonzalez, he was responsible, during the first half of the twentieth century, for leading French organ building back to the classical principles of the eighteenth century.

Gonzalez, born in Hacinas on 2 December 1877, became apprenticed to the firm of Aristide CAVAILLÉ-COLL at age seventeen; he learned woodworking, mechanics, tuning, and voicing. After the death of Cavaillé-Coll, he worked for several other firms. As a soldier in World War I, he was taken prisoner by the Germans in 1914; for more than half of the four and one-half years he spent in Germany, he was able to study organ building.

In 1921 Gonzalez formed a partnership with Victor Ephreme. During that same year he befriended the organist, André Marchal. For the next thirty-five years these two were to exercise great influence in France over the restoration of old organs and the building of new. With the support of Beranger de Miramon Fitz-James, founder and president of the newly formed Societé des Amis de l'Orgue, Gonzalez reorganized and expanded his firm in 1929 with his son Fernand as partner. He also trained Ramón González de Amezua y Noriega (b. 1921).

Among Gonzalez's more important works (new or restorations) were the Palais de Chaillot (1939), the Royal Chapel at Versailles (1938), the churches of St. Eustache (1945) and St. Merry (1947) in Paris, and the cathedrals of Rheims (1938), Soissons (1956), and Auch (1958). He strove for a proper balance among foundations, mixtures, and reeds, and for lower wind pressures. He was acknowledged for the clarity of his Principal choruses and for the brilliance, without heaviness, of his reeds. Gonzalez died in Paris on 3 June 1956. The firm continues under the direction of Gonzalez's grandson-in-law, Georges Danion.

WILLIAM HAYS

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GOODRICH, WILLIAM M(ARCELLUS) (1777–1833)

American organbuilder. Goodrich is often considered the "father" of Boston organ building. Born in Templeton, Massachusetts, on 21 July 1777, he was largely self-taught, although he associated with Henry Pratt, an organ tuner and repairer in Boston, as early as 1799. In 1804 he worked for a short time for the piano maker Benjamin Crehore, with whom he had an agreement to make "organized" pianos (the CLAVIORGANUM).

Late in 1804 Goodrich and his brother Ebenezer Goodrich (1782–1841) rented a workshop in the west end of Boston, where they made a small claviorganum. In 1806 they completed their first church organ, for Boston, Holy Cross Catholic. Ebenezer left to open his own workshop in 1807; he seems to have specialized in chamber organs, although he built a few small church organs as well and taught music on the side. One of his chamber organs is now in the collections of the Smithsonian Institution in Washington, D.C. His place was taken by Thomas Appleton, William Goodrich's first student. Between this time and 1821 Goodrich worked only sporadically on his own, most of his organs being built in the workshops of others. From 1812 to 1815 he and Appleton worked with Alpheus Babcock and the Hayt brothers. Later he worked under the aegis of Capt. John Mackay's Franklin Musical Warehouse; during this period Goodrich built a number of church organs, including several for southern U.S. cities. His 1817 instrument for Boston, New South Church, was favorably compared to imported instruments.

From 1821 to his death in East Cambridge, Massachusetts, on 15 September 1833, Goodrich maintained his own workshop, first in Boston and later in East Cambridge. Goodrich trained several men who would eventually become leaders of the Boston organ industry—Elias and George Hook, George and William Stevens, and J. H. Ware (of Holbrook And Ware). During this period some of Goodrich's largest organs were built, including a three-manual instrument for Boston, St. Paul's (1826). Contemporary accounts invariably praise the careful voicing and pleasing tone of these instruments. During his lifetime Goodrich is recorded as having built forty-five church organs as well as several chamber organs, but only three or four of these have survived to the present day in anything approaching their original state; the most significant is the two-manual instrument in the Nantucket, Massachusetts, Unitarian Church.

Barbara Owen

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GOODWIN, (D.) STEUART (B. 1942)

American organbuilder, design consultant, and tonal finisher. Born in Riverside, California, he studied music performance and composition, graduating from the University of Redlands (California) in 1964. He was awarded a 1964 Fulbright grant to study organ building in the Netherlands, endorsed by organist E. Power Biggs. Goodwin worked for D. A. Flentrop, then started Steuart Goodwin Pipe Organs in Redlands, California, in 1968. The firm has built a modest number of new instruments, using mechanical, electro-pneumatic, and electric action, as well as an equivalent number of rebuilt mechanical action organs and organs incorporating used materials. Goodwin has also worked with Manuel J. Rosales, and Schoenstein and Company.

Goodwin has a special affinity for Romantic and American classic organ styles and has worked on a number of prominent Ernest M. Skinner and Aeolian-Skinner instruments, including tonal finishing of the flue pipes for the 1989 restoration of the Mormon Tabernacle organ in Salt Lake City. He was also a facade designer for the 2003 Schoenstein organ in the Mormon Conference Center, also in Salt Lake City. He specializes in instruments that address the problems of small churches with limited funds in a thoughtful way. Steuart Goodwin Pipe Organs is now located in San Bernardino, California.

Arthur Lawrence

Bibliography

<http://goodwinorgans.com/>.

GRAND CHOEUR

(1) Before 1860. Nineteenth-century French registration term for grand choir, or full organ. The designation is often placed at the beginning of a work if not in its title, instructing the organist to use foundation stops, all chorus reeds (with the possible addition of the Hautbois), depending on the instrument and the taste of the organist. Unison couplers to manuals and pedal were to be engaged. Excluded from a Grand-Choeur were mixture stops, celeste stops including the Voix Céleste and Unda Maris, and solo reeds such as the Voix Humaine, Clarinette, and possibly the Cromorne.

After 1860. Cavaillé-Coll appears to have been haunted from the early days of his career with the notion of uniting the old Grand Plein-Jeu with the Grands Jeux (now called Grand-Choer). In January, 1857, Cavaillé-Coll provided the Carmelites of Bigorre a most unique instrument. The Grand Récit-Expressif, originally installed in the 1855 exposition organ, was equipped with a Plein-Jeu III consisting of 1 3/5', 1 1/3', 1/, non-repeating from CC-f'''. Joseph Merklin's organ built for the same exposition at St. Eugène, Paris (intact), made use of the first progressive and non-repeating mixture in France. Cavaillé-Coll followed suit, and provided his opus 115/60, built at St-Louis d'Antin

(Paris) in 1858, with his first Plein-Jeu Harmonique III-VI. The stage was set for organists to add mixtures to their Grand-Choeur registrations. This must have been a slow process as the established organists had been carefully taught never to mix elements of the Plein-Jeu with the old Grands-Jeux. Charles-Marie Widor may have been one of the first in the new generation emerging in the 1860s and 1870s to embrace Cavaillé-Coll's thinking and incorporate mixtures in his Grands-Choeurs. The overhaul of St-Sulpice in 1883, supervised by Widor, 'normalized" the position of the Récit Fourniture and Cymbale, placing them on the ventil with the reeds. Eugène Gigout specifically calls for the new registration in his Grand Choeur Dialogué ("1er Clavier [FF] = fonds et anches 16, 8, 4, 2 á tous les claviers, sauf à celui du 2e Chœur. Plein-jeu et Cornet.") By the closing decades of the century, evidence suggests that many organists assumed mixtures to be present in their Fonds et Anches 16-8-4 registrations, but it was left for organists born after 1900 to specify these stops clearly in their scores.

(2) A manual division on French instruments of five manuals. Cavaillé-Coll constructed two such instruments: St-Sulpice, Paris (1862) and Notre-Dame de Paris (1868). Both instruments provided for all manuals or combinations thereof to be played on the Grand-Choeur division, the first manual of the five. In the case of Notre-Dame de Paris, the manual was provided with 12 independent stops, but at St-Sulpice, the manual in reality only serves as a coupling division. The stops that appear in the specification to be assigned to the St-Sulpice Grand-Choeur are the Jeux de Combinaison (upperwork and reeds) of the Grand-Orgue, planted on the Grand-Orgue windchest, but speaking from the Jeux de Combinaison pallet box, the action of which can be played independently from the Grand-Choeur manual.

Jesse E. Eschbach

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GRAND JEU

French Classic registration based on reed sonority. Although the individual *Livres d'orgue* of the seventeenth and eighteenth centuries vary in detail, the overall concept is consistent: Grand Orgue: Trompette 8', Clarion 4', Grand Cornet, plus fonds stops such as the Bourdon 8' and Prestant 4'; the Grand Orgue is coupled to the Positif, which registered Cromorne 8', Bourdon 8', and Prestant 4'. Composers such as Guillaume-Gabriel Nivers (1665), Nicolas-Antoine LeBègue (1675), André Raison (1688), Jacques Boyvin (1689), Lambert Chaumont (1695), Gaspard Corrette (1703), and Michel Corrette (1737) sometimes include wide-scaled mutations as well. The Pedal is built upon a Trompette 8' to which the Clarion 4' could be added. The Récit and Echo manuals were frequently registered with Cornets.

Jesse E. Eschbach

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GRAND ORGUE

A division of the French classical, symphonic, and neoclassical organ dating back to the medieval Blockwerk or Fourniture. Equivalents are Hauptwerk (Ger.), Hoofdwerk (Dutch), and Great. The windchest associated with this division is always situated in the main case of the instrument.

Descending directly from the medieval Blockwerk, the Grand Orgue throughout its five-century history has invariably retained its plenum function (except in nineteenth-century choir organs). The lowest-pitched Principal stop is most commonly the Montre 16' or 8', although later eighteenth-century builders provided very large organs with a Montre 32' (St.-Sulpice, Paris, François-Henri Cliquot, 1781). Aristide Cavaillé-Coll employed a similar 32' plenum at St. Denis, 1841.

Flemish builders working in the north of France throughout the 16th and early 17th centuries equipped the division with a large array of wide-scaled registers from 16' to 1'. Parisian builders also added large-scaled tierce stops constructed from lead, leading to Jeu de Tierce registrations. The classical distribution of flutes was reached by 1660. Reed stops were also inherited from Flemish builders. A seventeenth- and eighteenth-century organ of medium to large size would always include a Trompette 8', Clairon 4', and Voix Humaine 8'. Extremely large instruments of the post-classical era (St-Martin, Tours, 1761, constructed by J. B. N. Lefèbre; St-Sulpice, Paris, 1781, by F.-H. Clicquot) provided for doubled Trompette and Clairon registers: Première Trompette 8', Deuxième Trompette 8', Première Clairon 4', Deuxième Clairon 4'.

The nineteenth-century Grand-orgue division maintained its classical outline. Often a plenum was maintained through the Cymbale (especially if old pipework was to be reused), as well as a Grand Cornet V and 16', and 8' Bourdon stops. Wide-scaled mutations, however, quickly disappeared from the Grand-Orgue in the 1830s. Contracts of the period show the 16' series (Grosse Tierce 3 1/5', Gros Nasard 5 1/3') sacrificed for the recently imported string stops (Gambe, Salicional, Dulciane) and the perfected harmonic flutes. The Nasard 2 2/3' and Tierce 1 3/5' disappeared quickly thereafter. The reed category was expanded to include a 16' Bombarde, but the Voix Humaine was transferred to the Récit. A Quinte 2 2/3' was added to the Grand-Orgue plenum, probably as the result of writings of Töpfer. By the middle 1840s, the basic framework for a symphonic Grand-Orgue had been crystallized by Cavaillé-Coll: 16' plenum including a Quinte 2 2/3', Bourdons 16' and 8', Harmonic Flute 8', string 8', Grand Cornet V, and reed battery 16', 8', 4'.

The neo-classical organ as pioneered by Victor Gonzales reintroduced mutations to the Grand-Orgue, usually at the expense of the Harmonic Flute 8' and string 8'. Frequently Sesquialteras were specified as well. It appears, however, that scalings, voicing techniques, and mixture compositions were practiced more as a reaction to post symphonic organs constructed the Mutin and Convers rather than as a logical development of traditional French practices.

Jesse E. Eschbach

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GRAND PLEIN JEU

A French term for *organo pleno* or PLENUM, a full complement of medium-scaled stops from the lowest pitch through the highest mixture available on a given instrument. Most sources of the seventeenth and eighteenth centuries double the 16' and 8' pitches with corresponding Bourdon stops. The qualifying adjective the grand usually denotes the Grand Orgue and Positif coupled. On a "Grand 16 pieds" organ of 1700, the registration would consist of Grand Orgue: Montre 16', Bourdon 16', Montre 8' Bourdon 8'. Prestant 4, Doublette 2; Positif: Montre 8', Bourdon 8', Prestant 4', Doublette 2', Fourniture, Cymbale coupled to the Positif. A separate 3' (2-2/3') medium-scaled register did not exist in the Parisian organ prior to the nineteenth century.

Jesse E. Eschbach

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GRANT, DEGENS AND BRADBEER

English organ-building firm. Based in London, this innovative partnership brought the neoclassical style of organ building to Britain. Although the neoclassical instrument was familiar to British organists through continental imports and Ralph Downes's schemes at the Royal Festival Hall and Brompton Oratory, these had had little influence on local builders' work, which remained Romantic with some upper work and foreign nomenclature.

In 1959, Maurice Forsyth-Grant, a wealthy industrialist and amateur pipe organ–maker, decided to sponsor a new pipe organ company. John Degens and Ted Rippen, two members of the quickly declining John H. Compton firm, set up Degens and Rippen. They initially oversaw conventional rebuilds in the Compton manner with what G. Donald HARRISON would have called "clarified ensembles." Forsyth-Grant, inspired by his continental travels and particularly the new German organs he saw, decided to take a more active role in guiding the firm's tonal philosophy. From their first entirely new instrument in 1964, the firm was the English pioneer of low-pressure voicing, with open feet and minimal nicking. Electric key action was replaced with mechanical from 1967 on. Other innovations of materials and techniques were applied (mostly successfully), such as aluminium trackers, fiberboard slider windchests, and schwimmers.

The firm produced about five new organs a year from 1966 until 1969. One characteristic feature was compound stops with unusual harmonics, such as aliquots. The more extreme examples have since been tuned to more conventional patterns, being of limited use and difficult to tune. Its magnum opus was in New College, Oxford (1969; 3/58), including an enclosed Swell with an unenclosed horizontal Trompeta Real. Several stops were provided by Forsyth-Grant as a gift. The architect Frank Bradbeer later joined the firm and designed distinctive, "neobrutalist" cases.

In 1970, Grant, Degens and Bradbeer gave up its London premises and moved to Northampton, leaving much of its work force behind. The last entirely new organ was completed in 1977. The firm only produced a total of twenty-nine new organs (and fifteen major rebuilds), but provided the inspiration (and at times the training) for a number of English organ firms. Although its tonal ethos has fallen from favor, its organs were the equal of their continental contemporaries.

ALASTAIR DISLEY

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GRATIAN, JOSEPH (1829–1897)

English-born American organbuilder. Born in Belper, Derbyshire, on 7 December 1829, Gratian came to America in 1857 and, after a brief stay in Quincy, Illinois, established an organ shop in Alton, Illinois, near St. Louis. His organs were built chiefly for churches in the Mississippi River Valley, though a few went to more distant locations. Gratian was an organist and member of the Episcopal Church, and built many of his instruments for that denomination.

Gratian's opus 1 (1858) for Alton, St. Paul's Episcopal, had recessed key desks. By the mid-1870s he was using terraced jambs. His early organs contained classical ensembles with well-developed Principal choruses, but the instruments under construction at his death reflected that period's taste for the 8' and 4' instruments with stops such as Vox Angelica and Flute d'Amour. Gratian patented a crescendo device (1879) that employed a pedal that was divided lengthwise. The right half controlled swell shutters, while the left half operated a stop-crescendo. The two halves could be operated independently or together.

In 1896 Gratian was injured by flying debris during a tornado and later that year suffered a stroke; he died at his home in Alton on 11 June 1897. He was succeeded in business by his son John William Gratian (b. ca. 1861; d. 12 Dec 1933) and later his grandson Warren Burke Gratian (b. 21 June 1891; d. June 1980). Joseph Gratian's small shop, while turning out only a few organs a year, had a reputation for craftsmanship.

ELIZABETH TOWNE SCHMITT

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GRAVISSIMA

SEE RESULTANT/ACOUSTIC BASS/GRAVISSIMA

GRAY AND DAVISON

English organ-building firm. Robert Gray (ca. 1742–1796) first appears as an organbuilder in Leigh Street, Red Lion Square, London in 1772. His brother William Gray (ca. 1757–1821) had joined him by 1784; they moved to premises in the New Road (later Euston Road) around 1787. After Robert's death William carried on the business, eventually succeeded by his own son, John Gray (ca. 1789–1849).

The firm's early work included chamber organs and instruments for the new churches being built in the London suburbs. Stoplists were largely conventional (Covent Garden, St. Paul, 1798; St. Martin-in-the-Fields, 1800) but they sometimes introduced a Violoncello stop into the Choir organ (actually a Cremona) and frequently provided an octave of pedals after about 1810. Pedal pipes were rare before the 1820s (although 16' doubles were provided for the large organ at St. Marylebone Parish, 1817); by that time they were also experimenting with larger swell boxes and secondary enclosure (Blackburn Parish, 1828).

In 1839 Frederick Davison (1815–1889) married John Gray's daughter. Shortly afterward, the firm became Gray and Davison. During a brief partnership with William HILL (1837–38), Davison pioneered the English version of the "German System" organ, with its C-compasses, complete Pedal divisions, and expanded flue and reed choruses. By the mid-1840s all these features appear in Gray and Davison's larger organs (Knightsbridge, St. Paul's, 1843; Limehouse, St. Anne, 1851). The firm's reputation reached its highest point in the 1850s, when a succession of major concert instruments were built in collaboration with the organist Henry Smart (1813–1879). These included Glasgow City Hall (1853), Birmingham Music Hall (1856), and the Handel Festival Organ in the Crystal Palace, Sydenham (1857), culminating in the organ for Leeds Town Hall (1859; 4/94). All reveal the influence of Aristide CAVAILLÉ-COLL in the use of pneumatic levers, application of higher wind pressures to the trebles of the chorus reeds, and extensive provision of harmonic registers. Some of these features found their way into the firm's larger church organs of the period as well: Oxford, Magdalen College (1855), Sherborne Abbey (1856), and Hereford Cathedral (1862).

In 1856, Gray and Davison acquired Bewsher and Fleetwood of Liverpool, which was maintained as a provincial branch of the parent company, with its own factory and workforce of around thirty. Following the closure of the factory there in 1890 it continued as a maintenance branch for a few more years.

The firm was eclipsed by more progressive builders after 1870. Frederick Davison's death caused a financial crisis, and the business went into voluntary liquidation (1890). Work continued from a new factory in Pratt Street, with Frederick's nephew, Charles Davidson (ca. 1854–1906) as managing director, and Gray and Davison Ltd. was incorporated in September 1894. The firm never regained its former eminence; the Davison family ceased to have any active involvement after 1930, and the business shut its doors in 1975.

NICHOLAS J. THISTLETHWAITE

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GREAT

A DIVISION of the organ, usually the largest. It would be hard to determine whether the Great or the Positiv is the older division of the pipe organ, since they both have their roots in antiquity. National variants of the Great (BLOCKWERK, GRAND ORGUE, HAUPTWERK, Hoofdwerk, Organo Grande, etc.) represented different tonal schemes, goals, and periods, but were similar in that they contained the basic FOUNDATION STOPS of the organ and functioned as the center of its design.

The Blockwerk was the earliest representation of this concept, and by the fifteenth century it had reached an astounding size, some containing more than thirty ranks of PRINCIPALS, but without a STOP ACTION. A modest Blockwerk of seventeen ranks of Principals from 1480 would have a disposition of 16.8.8.8.5-1/3.5-1/3.4.4.4.2-2/3.2-2/3.2-2/3.2.2.1-1/3.1-1/3—unheard of in modern specifications.

After the incorporation of SLIDER-effected stop action, the Great (used here as a generic term for this division and its relatives) grew to a maturity and breadth of design in the sixteenth and seventeenth centuries, using all four families of tone (principals, flutes, reeds, and strings). A generic stoplist from that age might read: 16.16.8.8.8.4.4.2-2/3.2.V.VI.V.16.8.8. This design combines both vertical (8.4.2) and horizontal (8.8.8) tonal elements. In the eighteenth and nineteenth centuries, variations in size and outlook occurred, but the Great remained the home for the major Principal CHORUS and the tonal center of the organ. Some have suggested that the Great became too large in the nineteenth century, but there were many instruments with forty-rank Greats during and even before Johann Sebastian Bach's time. Indeed, during the Romantic era there was an overall decline in the size of the Great relative to the size of the entire instrument, as other divisions rose to prominence.

One of the most difficult aspects in studying the Great and its history is the difference in national styles, along with the changes within each national style over the centuries. If the Great can be thought of as originating in the Low Countries and spreading throughout Europe from there, it seemed to acquire a new life of its own in each new location. In Germany, the LOW COUNTRIES, and FRANCE, large, tonally mature instruments were common from the early Baroque (seventeenth century). In France, the GRAND ORGUE achieved monumental size compared to the other divisions. In northern Europe, other divisions were nearly equal in size to the Great. In Italy and Spain, the Organo Grande was large compared to the other divisions, and many instruments had only one MANUAL. Southern European VOICING was lighter than in northern areas, and many of the higher pitched Principals were available separately, rather than being bound up in MIXTURES.

In England, the overall size of the organ remained small, compared to continental instruments, until the mid-nineteenth century; likewise, the Great remained small compared to developments across the channel. Fortunately, even though organs were small, the Principal chorus on the Great remained complete, so that integrity and musicality were intact, if on a reduced scale. In the United States, organs followed European influences, but with interesting variations to suit church needs in the new land. In New England, the instruments followed the ideas of the small English organs, while farther west, German builders created their own versions of the small Central European instruments. A modest Principal chorus was the norm for the Great on these early American instruments; it was not until the nineteenth century that large-scale Greats with fully developed choruses appeared.

By the early twentieth century, the Great had lost much of its upper work and chorus reeds. The tonal design was becoming more horizontal with each succeeding decade, as flutes and strings took the place of the vertical Principal chorus. By 1910, it was not unusual to find a Great of 8.8.8.8.8.8.8.4—and the 4' was a soft flute!

With the revival of vertical tonal design in the 1930s, upper work returned to the Great, but it was a long, slow process for builders to rediscover how to scale and voice mixtures to achieve the sounds long lost to the performer. Even though the upper work returned to the Great, the reeds were often ignored, and even the largest organs built between 1930 and 1950 might have been without them, even on a stoplist with perhaps thirty or more ranks on the Great (and not a single reed).

With the academic interest in the organ in the 1960s and the ORGAN REFORM MOVEMENT underway, a different slant to the design of the Great evolved. Rejecting horizontal elements in tonal design, the Great became almost purely vertical, and a stoplist of 8.4.2.1-1/3.IV.8 was typical of thinking during this time. Such rejection of the balanced Great of the seventeenth century was disappointing and excessive; builders soon realized that a combination of horizontal and vertical concepts was necessary to return musicality to the instrument.

Today, there are as many different approaches to designing the Great as there are builders, and nearly every period and national concept has been rediscovered and tried. But within this diversity, the Great still maintains its position as the foundation of the organ, and the division from which all else in the organ is derived or centered upon.

See also **Stop**

CHARLES HENDRICKSON

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GREEN, SAMUEL (1740–1796)

English organbuilder. Green was born in Wheatley, near Oxford. The son of a distiller, he was apprenticed to a London clockmaker and organbuilder, George Pyke (1754–61). Green may have then worked for John BYFIELD II and John SNETZLER. In 1768 he entered a partnership with Byfield, building or rebuilding instruments in Oxford (St. John's and Jesus Colleges; St. Peter–in–the–East), London (Soho, Berwick Street Chapel; Drury Lane Theater; Pimlico, Charlotte Chapel; Islington, St. Mary; Barking), and at Ely Cathedral; Wigan, All Saints; and Newbury, St. Nicholas. In 1772 Green became a freeman, set up his own business, and married Sarah Norton, daughter of a musical and astronomical clockmaker. Thereafter, he worked in Holborn (to ca. 1777), Islington (to ca. 1786), and, from 1789 on, Isleworth, Middlesex. When Snetzler retired (1780), Green became royal organbuilder for George III (who may have known of Green through Pyke, whose father also benefited from royal patronage). After Green's death in Isleworth on 14 September 1796, his widow and his foreman, Benjamin Blyth (as part of Green and Blyth), completed or built new projects through 1804.

Wickens lists over ninety Green organs, noting that thirteen of Green's one-manual chamber organs (1777–96) survive with relatively few changes; no complete church organ survives, however. Green retained a more-or-less consistent design throughout his career concerning key and stop actions, sliding manual, and windchests. He introduced the double-rise PARALLEL RESERVOIR into the East Bradenham (1786) and Attingham (1788) chamber organs. In 1787, he gave full enclosures and complete SWELL capability to the Herefordshire and Edith Weston chamber instruments. Green also experimented with the shifting movement (MACHINE STOP), an early form of cancellation pedal.

Tonal design in Green's two-manual church organs centers on the Great chorus of Diapasons and Principals plus a Mixture, Cornet, and Trumpet; occasionally a Flute, Tierce, or Clarion is used. The Choir organs use a reduced Diapason-Principal chorus (Stopped Diapason, Dulciana, Principal, Fifteenth) plus a Flute and, in many cases, a Bassoon. The Swell division, of which Green was a major proponent, has a reduced Diapason-Principal chorus and a complement of three reeds (Cornet, Hautboy, Trumpet). The chamber organs add a Flute to the reduced Diapason-Principal design.

RICHARD KASSEL

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GRENIÉ, GABRIEL-JOSEPH (1756 OR 1757–1837)

French musical instrument maker and inventor of the *orgue expressif*, an early form of REED ORGAN. A native of Bordeaux, Grenié built and exhibited the orgue expressif in Paris in 1810. As early as 1790 he is said to have built a two-octave free-reed instrument. In his letters of patent (1810), Grenié acknowledged the work of Sebastien Érard (1752–1831), Georg Joseph VOGLER, and others toward the development of an organ capable of expression; but he claimed that *L'arte du facteur d'orgues* of François BÉDOS DE CELLES was the starting point for his efforts. Although he may have misunderstood Bédos de Celles's remarks concerning the FREE REED, Grenié was the first to produce a viable keyboard instrument furnished entirely with them. Grenié himself saw the place of his instrument in the musical hierarchy as somewhere between the piano and the pipe organ.

In 1815 Grenié installed an *orgue expressif* in the Dames du Sacre-Coeur in Paris; between 1812 and 1819, he built a mixed organ for the Paris Conservatory, using the flue stop system for the first keyboard, the freely vibrating reed system for the second, and a combination of the two for the pedalboard. François Benoist was trained on this organ from 1819 to 1822. Grenié died in Paris on 3 September 1837.

The *orgue expressif* had all the basic components of a small chamber pipe organ, with one manual of five octaves (FFF to f'') and one set of reeds. Two foot-operated pumps supplied pressure to a reservoir and windchest on which the pipes were mounted. These, however, were provided with pear-shaped housings containing the free reeds, the pipes themselves acting only as qualifying tubes. Dynamics were made possible by the double bellows system, which enabled the player to supply air to the reeds in varying degrees by means of treadles, thus taking advantage of the free reeds' unique capability of increasing or decreasing in volume according to the wind supplied to them, but with only miniscule changes in pitch.

As a drawing from Bédos de Celles reveals, upper reeds are mounted at the tops of the pipes in housings reminiscent of the tuning handles of a stopped organ pipe, while in the longer, lower-pitched pipes, the reeds are mounted directly in the sides of the pipes themselves. On the right end of the manual was a control that allowed the air from the bellows to bypass the reservoir and its equalizing effect and enter directly into the windchest. This allowed an even more intimate control of dynamics by the player, foreshadowing the later expression stop of the harmonium. One of Grenié's apprentices, Theodore Achille Müller, later made significant improvements to the instrument. The term *orgue expressif* was applied by French makers to later pressure free-reed instruments, particularly after the patenting of the name *harmonium* by Alexander François DEBAIN.

JAMES HOWARD RICHARDS

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GRONINGEN

SEE EMS-DOLLART REGION; LOW COUNTRIES

GUILBAULT-THÉRIEN

Canadian firm based in St. Hyacinthe, Quebec. It was founded in 1946 as the Providence Organ Company (La Providence, Quebec) as a partnership between Maurice Guilbault (1903–1969, a former CASAVANT FRÈRES employee) and Antonio Delage. In 1955, Maurice Guilbault's son André (b. 1937) joined the company as an apprentice. The firm gradually abandoned the organ supplies business to focus on building new organs; it was incorporated in 1961. When André Guilbault took over the management of the firm in 1968, Guy Thérien (1947–2001), a former apprentice at Casavant, joined as a partner.

Guilbault-Thérien (so renamed in 1978) was one of the first Canadian companies to meet local organists' demands for tracker action instruments, in keeping with the postwar neobaroque movement. Previously, these performers had turned to German builders (Rudolf von BECKERATH, Hellmuth WOLFF) to fill the void. Guilbault-Thérien built several new tracker organs, large and small, with French classical dispositions, for Canadian (a majority for Quebec, also Ontario and other provinces) and American (White Plains, NY, Grace Episcopal, 1989) destinations. The firm moved in 1985 to St.-Thomas-d'Aquin, Quebec. In 1992, André Guilbault retired, and Alain Guilbault (no relation) bought an interest in the firm. After Thérien's death, Alain Guilbault reconstituted the firm with new partners, renaming it Guilbault Bellavance Carignan.

Besides its new instruments, Guilbault-Thérien was active in rebuilding earlier instruments. Two notable are examples in Montreal In 1984, the firm worked on the 1897 Casavant Frères organ at St. George's (Anglican), enlarging it to 4/39, replacing electro-pneumatics with suspended tracker action (except the Horizontal Trumpet), converting the winding to electric power and incorporating SOLID STATE LOGIC combination action. One of its most historic rebuilds is located at the Grand Séminaire Chapel (Sulpician, the oldest standing structure in Montreal). A 1907 J. E. Pépin tubular-pneumatic organ, electrified by Casavant (1938) and enlarged by Odilon Jacques (1964; 3/39), was rebuilt in 1990, with a new suspended action made entirely of wood, the option of manual or electric winding, and irregular (Rameau) temperament.

RICHARD KASSEL

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GURLITT, WILIBALD (WILLIBALD) (1889–1963)

German musicologist, performer, and organ consultant. Gurlitt, born in Dresden on 1 March 1889, was the son of the architect and art historian Cornelius Gurlitt. Wilibald Gurlitt studied musicology and history in Heidelberg and Leipzig with, among others, Hugo Riemann and Arnold Schering, writing his 1914 dissertation on Michael PRAETORIUS. Gurlitt was particularly influential in the revival of early music, directing performances of medieval music with the University of Freiburg's Collegium Musicum in the early 1920s. He also played an important role in the ORGAN REFORM MOVEMENT. In 1921 he assisted in the construction of the "Praetorius Organ" in Freiburg, based on the specifications published in Praetorius's *Syntagma musicum* II (1619); destroyed in 1944, it was rebuilt in 1955. His research included the study of organs, organ music, and Protestant church music. He edited the twelfth edition of the *Riemann Musik Lexikon* (1959–61) and prepared critical editions of music by Gilles Binchois, Dietrich Buxtehude, and Praetorius. In 1949 he initiated the in-depth terminological encyclopedia *Handwörterbuch der musikalischen Terminologie*, which was continued by Hans Heinrich Eggebrecht. Gurlitt died in Freiburg on 15 December 1963.

DANIEL F. BOOMHOWER

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GWYNN, DOMINIC

SEE GOETZ AND GWYNN

H

HAAS, FRIEDRICH (1811–1886)

German-born Swiss organbuilder. Born in Laufenburg, Baden, on 10 February 1811, Haas began his organ studies with the Schaxel family (1825–29), apprenticing alternately with the elder Schaxel (in Herbolzheim) and his two sons (in Benfeld, Alsace). From 1830 to 1835 he worked with the E. F. Walcker firm in Ludwigsburg; thereafter he established his own business. After 1840 he worked exclusively in Switzerland and, along with Aloys Mooser, became one of the most important organbuilders in that country. At first, he journeyed from place to place (other than his brothers Wilhelm and Bertold Haas, he never had more than two associates) until moving to Lucerne in 1859 to begin a renovation of the Hofkirche organ. He settled there, was granted citizenship in both the city and canton, and founded the firm that was passed on to his colleague Friedrich Goll in 1868. After 1868 he continued working as an organ consultant; he died in Lucerne on 28 July 1886. The firm he established continues operations today as Goll Orgelbau.

Haas played an important role in the transition from the South German Baroque organ to the Romantic organ. Of particular importance was his acquaintance with Aristide Cavaillé-Coll in Bern in 1844 and their ensuing friendship. In 1846 he went to Paris to study some new Romantic organ-building techniques, such as construction and voicing of reeds, the Barker lever, and winding, and he gained further expertise in building and working with cone-chests such as those Walcker used. These new trends were immediately incorporated into his own instruments.

While building the organ for the Basel cathedral, Haas met Johann Gottlob Töpfer, who was active as an organ consultant. This resulted in several changes, especially in his calculation in pipe scalings. Before 1846 his instruments had largely reflected the styles and techniques learned while he had worked with Walcker; he now synthesized German and French construction principles and produced his own unique style that exerted a pronounced influence on Swiss organ building for several generations. His instruments retained the tonal spectrum of the German Romantic organ with its broad base of foundation flue stops and tone colors; the reed stops showed the influence of Cavaillé-Coll. While he continued to use the cone-chest, winding principles were largely drawn from Cavaillé-Coll (double-fold bellows and differentiated wind pressures). His personal contributions to organ building include the use of combination pedals and a bellows machine that helped provide a good wind supply. He also made a number of contributions to Töpfer's *Lehrbuch der Orgelbaukunst* (1855).

Important Swiss organs built or renovated by Haas include: Grenzach (1837); Neumünster, Zurich (1838–40; 3/36); Rheinau (1840–41); Stadtkirche, Winterthur (1841–43); Andelfingen (1842–43); Zofingen (1847); Bern Cathedral (1849–51); Lenzburg (1851); Fribourg Cathedral (1852–53); Basel Cathedral (1852–57; 4/60); Hofkirche, Lucerne, reb. 1648 Geissler organ (1859–62; 5/84; rest. Kuhn, 1972–77); and Thalwil (1864).

See also **Switzerland**

Douglas E. Bush

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HAERPFER

French organ-building family. Charles Haerpfer (b. Nordlingen, Bavaria, 7 June 1835; d. 1919) was trained by STEINMEYER and E. F. WALCKER in Germany and HAAS in Switzerland; Nicolas Dalstein (b. Lorraine, 15 June 1834; d. 1900) was trained as a carpenter. They met in Paris while working on the construction of the Cavaillé-Coll organ at St.-Sulpice. Their organ factory in Boulay (Lorraine) was founded in 1863 as Dalstein-Haerpfer. From 1893 on they built instruments in the style of Walcker, with mostly cone-chests and mechanical (later pneumatic) actions. Aristide CAVAILLE-COLL's influence can be seen only in the larger instruments, such as Nancy, St.-Sebastian (1881; 3/46) or Hayange (1895; 3/53); both are well preserved.

From 1905 on the direction of Dalstein-Haerpfer came increasingly under the control of the founders' sons, Frederic Haerpfer (1879–1956) and Paul Dalstein (1868–1926). Haerpfer formed especially close links with Albert SCHWEITZER, who furnished the plans for the organs of Strasbourg-Cronenbourg (1907; 2/32) and the Sangerhaus organ in Strasbourg (1909; 2/33), used by Schweitzer to record the works of Johann Sebastian Bach and César Franck in 1937.

After World War I the factory was taken over by Frederic Haerpfer, who made many pneumatic action instruments, including Gunsbach, for Schweitzer (1931; 2/22); he experimented with electric tracker action, notably for the organ in Metz Cathedral (1934; 3/47). In 1946 Haerpfer left the organ factory to become an expert in postwar reconstruction. A new business was founded by his son Walther Haerpfer (1909–1975) with a new associate, Pierre Erman (1913–1990), under the name Haerpfer-Erman. Benefiting from the support of the federal beaux arts administration and that of organists like Marie-Claire Alain and Gaston Litaize, the factory made many neoclassical organs, most with electric tracker action, until 1960, when they shifted to mechanical action. Their most remarkable achievements of this period are the organs of St.-Quentin (1967; 4/75), and St.-Germain-des-Pres in Paris (1973; 4/56). In 1975, Walther Haerpfer's son Theo Haerpfer (1946–1999) took his place, first in association with Erman, then alone from 1979 on. He built organs with mechanical tracker action, of which the most successful are Forbach, Protestant church (1988–1997; 3/23) and St.-Nicolas-de-Port (1994; 4/49). The business closed in 1999.

CHRISTIAN LUTZ

Translated by Moira Tierney

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HAGERBEER, VAN

Dutch organ-building family. Although biographical information is scant, Germer Galtusz[oon] van Hagerbeer (d. before 1651), Galtus Germersz[oon] van Hagerbeer, and Jacobus Galtus[zoon] van Hagerbeer (d. after 1679) were active between 1625 and 1680. The family relationship among the builders is not firmly established; the first was probably the father or stepfather of the latter two. The family's fame as organbuilders followed Jan Pieterszoon Sweelinck's death (1621); this was apparently not mere coincidence, whether on professional or personal grounds. Although all three van Hagerbeers worked together in Amersfoort, Jacobus later went out on his own in Amsterdam. There are occasional ambiguities as to which van Hagerbeer built a particular instrument.

The first known van Hagerbeer organ was built by Galtus at The Hague, Grote of St. Jacobskerk, 1626/29 (2/23/pull-down; moved to The Hague, Reformed Convent, 1680). Germer and Galtus restored and enlarged the 1551 C. Gerritsz instrument at Amersfoort, Large-or St. Joriskerk, 1634–36 (3/24/pull-down; repl. Naber, 1845), and rebuilt the 1622 Hocque/1634 Goldfuss main organ at 's-Hertogenbosch, St. John's Cathedral, 1635–38 (1774 disposition: 3/34/pull-down, split keys on Rugpositief; rest. Flentrop, 1984).

Two organs, apparently worked on by all three family members, are their best-known surviving instruments, and have been often used for recordings. The first was installed at Alkmaar, Cathedral of St. Lawrence, sometime between 1638 and 1646 (3/35/pull-down; Pedal added 1685). The organ exemplifies the Netherlandish balance between North German (foundation stops) and French elements (mixtures and aliquots). The instrument was rebuilt by Franz Caspar SCHNITGER (1722–25, 3/54; rest. Flentrop to 1725 state, 1982–86; 3/57).

The second was a rebuild of the 1446 van Bilstein/1518 Jan van Covelens/1629 van Lin organ at Leiden, Pieterskerk. The original contract is dated 1638, but the job was not certified until 1643 (3/26). The van Hagerbeers renovated the HOOFDWERK (divided into three chests) and the Bovenwerk (two chests), and completely rebuilt the Rugwerk; they reused some of the original pipes. Jacobus held its maintenance contract, but gave it up to his former apprentice, Johannes Duyschot (1645–1725) in 1679. The instrument endured the typical pattern of renovations; Berens Lohman reinvented it as a Romantic organ (1843–45); van Leeuwen restored the instrument twice (1943–46, 1960; 3/43); finally, VERSCHUEREN returned the organ to its seventeenth-century state with some pre-Romantic additions incorporated (1994–98; 3/36). Germer and Galtus rebuilt the organs at Monnikendam, Cathedral of St. Nicholas (1639) and Haarlem, St. Bavo's Cathedral (1523 JAN VAN COVELENS organ; (reb. date unknown); the latter instrument was moved to Haarlem, Nieuwe Kerk (1791) and twice restored by VAN VULPEN (1958, 1985; now 2/22).

The van Hagerbeers worked on solo projects as well. Germer enlarged a 1565 Peter Jans DE SWART organ at Leiden, Hooglandse Kerk in 1637 (2/10; rest. J. Ahrend, 1979–80). He also worked on the royal chapel organ in The Hague, notable for its split keys to offset the wolf fifth (1641). In 1644, Germer was commissioned to restore the choir organ at Amsterdam, Nieuwe Kerk (2/15/pull-down); a fire at the church delayed the work; by the time it became possible to resume work, Germer had died; the job was taken over by Jacobus. The initial work was completed in 1651; by 1664, Jacobus had returned to renovate the instrument, replacing its Borstwerk with a Rugpositief on the transept organ gallery and making other changes. The organ was restored by D. A. FLENTROP to its 1664 state (1986–89).

Other work by Jacobus included repairs of the 1511 van Covelens choir organ at Alkmaar, Cathedral of St. Lawrence (1651; rest. Flentrop, 2000, 2/13); building the organ at Purmerend, 1656 (reb. Rudolph Garrels, 1737–42; rest. Flentrop, 2001–03); and the completion of the Theodorus Faber instrument at Groningen, Aakerk, begun in 1654 but interrupted by Faber's death in 1659. Jacobus completed the instrument in 1667—four years before the church tower was struck by lightning, causing a fire that destroyed the organ.

RICHARD KASSEL

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HALF-LENGTH STOP

A stop whose pipes are closed at the top (covered, *gedeckt*). Since the airstream travels twice the length of the pipe, these pipes sound at the same octave as an open Principal twice their length—for example, a stopped 8' pipe sounds like an open 16' pipe. Where space limitations are a factor (notably, in HOUSE ORGANS), the half-length stop produces otherwise unfeasible bass register ranks. A few half-length reed stops (striking and free) have been specifically designed, keeping in mind the acoustical law by which a half-length pipe emphasizes odd-numbered partials: Cromorne (Krummhorn, fifteenth century), Musette (eighteenth century), and Clarinet (late eighteenth century). However, the dynamic level and overall impact of a half-length stop is less than its full-length equivalent, due partly to the loss of some of the fundamental pitch; some criticize the corresponding change in tonal color as well as the unevenness heard when alternating between half- and full-length stops.

See also **Stopped Pipe**

RICHARD KASSEL

HALF-STOP

A solo stop (also called halved-stop) that plays a rank or ranks of pipes from only part of a keyboard, usually the upper octaves (often beginning on c'), creating a "short register." The half-stop is in essence a form of RÉCIT. This kind of stop was common on Baroque organs, initially on the Iberian Peninsula, and was revived on the neobaroque organ of the latter twentieth century. In cases where a DIVIDED STOP is employed, separate half-stops for treble and bass registers are used.

HALF-STOPPED PIPE

SEE STOPPED PIPE

HALL, JAMES (1803–1888)

American organbuilder. Born in Philadelphia, he probably served an apprenticeship with his older brother, Thomas S. HALL, beginning about 1816. Before April 1825, he entered a Philadelphia partnership with Wilfred [Welford] Hall, who may have been his cousin. In 1826, James Hall was living in New York at Thomas Hall's address; by 1827, he had moved back to Philadelphia. In 1845, he relocated to Baltimore, where from 1853 to 1866 he served as an agent for the local branch of Henry ERBEN's manufactory; he died in that city in 1888. Both the extent and quality of Hall's work is difficult to determine. Two of his instruments were built for Christ Church, Easton (1848), and Grace Church, Elk's Ridge Landing (1848), both in Maryland.

STEPHEN L. PINEL

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HALL, THOMAS S. (1794–1874)

American organbuilder of English birth. Hall's significance among nineteenth-century New York organbuilders lies not only in his own work but his training those who became major figures in the "New York City school," among them Henry ERBEN, Richard M. FERRIS, and Hilborne L. ROOSEVELT. Of the major New York builders during the 1800s, only George JARDINE did not train under Hall.

Hall was born in England around 8 February 1794; his family had emigrated to Philadelphia by 1803. A few years later, he began his apprenticeship with John LOWE, another British immigrant. In 1813, Hall was sent to New York to install a new Lowe organ in St. John's Chapel. The instrument, traveling by sea, was seized by a British blockade vessel; by the time it was ransomed, Lowe had died. Hall installed the organ, then returned to Philadelphia; by 1818, he was back in New York and building organs under his own name. He married the daughter of Peter Erben, organist of St. John's Chapel, and took on the latter's son, Henry Erben, as an apprentice.

From 1818 to 1824, Hall built for several prominent churches, among them the old Roman Catholic Cathedral, Baltimore (1821; case survives), St. Paul's Episcopal, Augusta, Georgia (1822), Christ Episcopal, Norfolk, Virginia (1822), St. George's Episcopal, New York (1822), and St. John's Lutheran, Charleston, South Carolina (1823; case survives). The only Hall organ from the period is an 1823 single-manual built for St. Michael's Episcopal, Litchfield, Connecticut, now in the gallery of Trinity Church in nearby Milton, Connecticut.

In March 1824, the brothers-in-law formed a partnership, Hall and Erben; three years later it was dissolved, and Erben became sole owner. Hall remained in his former apprentice's employ, evidently in charge of the day-to-day operations of the shop. In October 1843, he left Erben; three years later, he entered into a partnership with John Labagh (1810–1892). Hall and Labagh fulfilled numerous New York commissions, among them St. Thomas Episcopal (two organs, 1852 and 1870; the latter had one of the first electric Pedal actions), Trinity Chapel Episcopal (1853), Trinity Episcopal (1864), and Temple Emanuel (1869). Hall retired in 1872, dying in New York on 23 May 1874.

The tonal design of Hall's early instruments exhibit the English influence typical for the period. Great divisions were built on open and stopped unison Diapasons with an Octave, Twelfth, Fifteenth, sometimes an independent Tierce, and one or two Mixtures, probably containing Tierce ranks. Swell divisions are smaller, based again on stopped and open unison ranks, with Octave and Superoctave stops, and solo voices. The Baltimore organ had a comparatively large Pedal division: four stops, one at 32'; however, most of Hall's organs had pull-down pedals. Similarly, the later Hall and Labagh organs follow the period's pattern of American organ building. English-style choruses gave way increasingly to varied solo colors, increased dynamic level, and larger scales. Pedal divisions had a few independent ranks, usually no more than three or four, even on large instruments.

JOHN K. OGASAPIAN

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HAMMER

German organ-building firm. The original firm was begun by Philipp Furtwängler (b. Gütenbach bei Furtwangen, 6 Apr 1800; d. Elze near Hannover, 5 July 1867), who settled in Elze in 1822 and built and repaired mechanical devices. He trained himself to build organs, establishing a business in 1838 to build organs and "tower clocks"; he built his first organ for Amelsen (lost). His son Wilhelm Furtwängler (b. Elze, 5 June 1829; d. there, 3 Sept 1883) joined the firm, now Ph. Furtwängler and Sohn, in 1854; when another son, Pius Furtwängler (b. Elze, 14 July 1841; d. Hannover, 16 January 1910) joined in 1867 (the year of Philipp's death), it became Ph. Furtwängler and Söhne. The two sons continued to operate the firm, building over two hundred organs before the company dissolved in 1883, the year Wilhelm Furtwängler died. His son, also named Wilhelm Furtwängler, would become head of GIESECKE AND SON in 1912.

Pius Furtwängler moved to Hannover and joined with Adolf Hammer (b. Herzberg im Harz, 6 Apr 1854; d. Hannover, 5 Mar 1921) to found P. Furtwängler and Hammer in 1883. After the death of Adolf Hammer, his son, Walter Hammer (b. 1900), took over the directorship of the company, which now had 120 employees. The economic crisis in the aftermath of World War I caused difficult times for the firm. Adolf Hammer's nephew, Emil Hammer (b. Wesermünde, 22 Feb 1878; d. Hannover, 3 Dec 1958) became a partner; by 1937 he was sole proprietor of the firm, now called Emil Hammer Orgelbau. After Emil's death, his grandson Christian Eickhoff (b. Shanghai, 23 Dec 1935) became managing director of Emil Hammer Orgelbau; he had trained with his grandfather, with Theodor KUHN in Switzerland, with Axel Starup in Copenhagen, and at the Technical Institute in Ludwigsburg. The firm built a new factory in Hemmingen/Arnum near Hannover in 1966.

Philipp Furtwängler built tracker organs with slider-chests and followed Johann Gottlob TÖPFER's "normal scaling" (Gronau, Evangelical Church, 1859; 3/57); in 1875 the firm built its first cone-chests. Its first organs with tubular-pneumatic actions were constructed in 1893; its first with electro-pneumatic action date from 1907 (Hannover, Stadthalle, Kuppelsaal, 1914; 3/124; destr. World War II). At the instigation of Christhard Mahrenholz, the firm began its association with the ORGAN REFORM MOVEMENT with the organ built for Göttingen, St. Marien (1925–26; 3/45). In 1931 their first organ to return to slider-chests and tracker action, now standard in all their instruments, was built for Hamburg-Langenhorn, followed by an instrument for Hannover, Marktkirche (1952–54; 4/53).

Some recent organs include: Sendai, Japan (1970; 2/30); Nevada, Missouri, Cottey College (1971; 2/17); Hannover, St. Elisabeth (1982; 3/36); Hannover, St. Godehard (1987; 3/37); Maniowy (Poland) (1993; 2/29); Lübeck, Bugenhagen-Kirche (1996; 2/24); and Hamersleben, St. Pancratius (2002; 3/41). Recent restorations include: Lamspringe, Klosterkirche, 1876 organ (1982/1990; 3/45); Vorsfelde, St. Petri, 1931 organ (1987; 2/29); Ramelsloh, 1912 organ (1999; 2/17); and Liegnitz (Legnica, PO), Liebfrauenkirche, 1914 Weigle organ (2000; 3/46).

DOUGLAS E. BUSH

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HAMMOND ORGAN COMPANY

SEE ELECTRONIC ORGAN

HARMONICA

A small-scaled flute/string hybrid stop of 8' pitch. It has a soft, bright tone which has been described as an Echo Violone. The pipes are usually made of wood, may have beards, and are sometimes slightly pyramidal. As described by George A. AUDSLEY, who provided the illustration reproduced here, the pipes of the Harmonica have circular mouths, hollowed on the inside. The name was also used for a free-reed stop similar to the Physharmonika.

See also **Free reed; Stop**

EDWARD L. STAUFF

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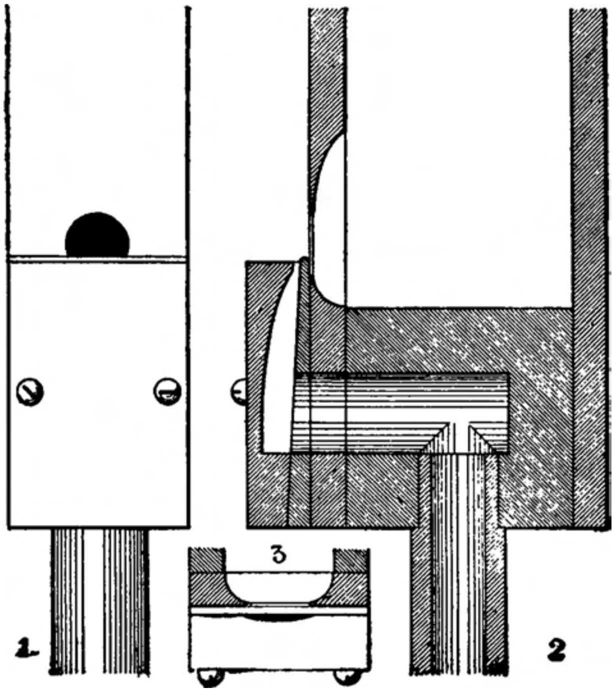

Fig. 46. Harmonica.

HARMONIC BRIDGE

See Beard

HARMONIC FLUTE/FLÛTE HARMONIQUE

An open 8' or 4', wood or metal Flute; like other harmonic stops, the rank uses double-length pipes with a hole pierced halfway up, so that they speak at the second partial (octave), with the fundamental more felt than heard; there are also stopped harmonic forms. While there is some variety of volume and voicing, the overall effect is of a light-toned Orchestral Flute, penetrating without undesirable harmonics, effective as a solo and when brightening a chorus. Other names for this stop are Traversflöte, Querflöte, and Flauto Traverso.

See also **Stop**

HARMONIC STOP

Stops that sound at a harmonic, or overtone, instead of at the pipe's fundamental pitch; the double-length pipe, producing a pitch an octave higher than would otherwise occur, is a common type (i.e., a 16' pipe that sounds an 8' pitch). There are early examples in German organ building; Michael Praetorius, in his *Syntagma musicum* II (1619), describes a Querfloit that overblows to its second partial. Harmonic stops only became standard on French organs in the nineteenth century, when Aristide Cavaillé-Coll began to place one or more small holes in the middle of the bodies of open Flute pipes (wood or cylindrical metal; St. Denis, near Paris, 1841). The hole causes the air column to split, sounding the octave above; he also introduced harmonic reeds. Harmonic pipes usually begin only in the 8' register; the bass pipes are constructed in the normal way. The English organbuilder Henry Willis further developed the design of harmonic reeds.

Heather Hernandez

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HARMONIUM

See Reed Organ

HARP

A name given to three different stops.

(1) A percussion stop consisting of tuned metal or wooden bars, suspended over tuned resonators, and struck by padded electric or pneumatic hammers. This is the most common Harp stop. Like other tuned percussion stops, it is often of short compass. Ernest M. Skinner considered Celesta and Glockenspiel to be the same stop, pitched an octave higher. On theater organs the Harp sounds a single stroke each time a key is pressed; the Marimba is the same stop with a reiterating action.

(2) A type of Regal found on some organs in the sixteenth through eighteenth centuries, sometimes called "Harfenregal."

(3) In 1733 Thomas Schwarbrick placed three string stops in the organ for the St. Michael, Coventry. These stops, Harp, Lute, and Dulcimer, used actual strings, and may have been actuated by a harpsichord mechanism. The difficulty of keeping them in tune led to their removal in 1763.

See also **Stop**

Edward L. Stauff

HARRIS, MURRAY M. (1866–1922)

American organbuilder. Born in Illinois, the son of a Presbyterian minister, Harris learned organ building with George S. Hutchings of Boston. During his first years in Los Angeles he served as Hutchings's local representative until 1898. In 1894, as southern California's first organbuilder, he established himself in a small rented shop in Los Angeles. One year later he constructed the first pipe organ in southern California, for Sierra Madre, Church of the Ascension (2/12).

Some of the organs built by Harris include Los Angeles, First Methodist, (1900); Palo Alto, Stanford University (1901), and San Francisco, Calvary Presbyterian (1903). These instruments made him a prominent figure in California music and business circles, and helped win him the contract to build the organ for the 1904 Louisiana Purchase Exhibition to be held in St. Louis. This instrument was designed by George A. Audsley and at the time of its construction was the largest organ in the world, having 140 speaking stops controlled from a five-manual console.

Serious financial problems with the St. Louis organ forced Harris to give up his controlling interest in the firm in 1903. The name was changed to the Los Angeles Art Organ Company, and the St. Louis organ was completed along with a number of sizable contracts, including Los Angeles, Christ Episcopal (1904); Venice Auditorium (1905); and two organs in San Francisco, Sherith Israel Synagogue (1905) and Old St. Mary's Catholic (1905). The Los Angeles Art Organ Company relocated to Hoboken, NJ, changed its name to the Electrolian Organ Company, and was out of business by 1906.

Many of Harris's workers returned to Los Angeles, and in 1906 he opened the Murray M. Harris Organ Company with a staff of fifty men. As before, small two-manual instruments were built with tubular-pneumatic action; larger organs used electro-pneumatic action. Some of the prominent instruments produced during this period were for Pasadena, California, Presbyterian (1907); Los Angeles, Second Church of Christ, Scientist (1910), Los Angeles, St. Paul's Episcopal Cathedral (1911), and the residence of Senator William A. Clark in New York (1911).

In 1913 Harris sold his company to E. S. Johnston, who moved the firm to Van Nuys, California. The firm changed hands in 1915, becoming the California Organ Company and, in 1917, the Robert Morton Organ Company. During the 1920s Robert Morton became the second largest producer of theater organs in America. The Morgan Company closed permanently in 1933.

After leaving the organ business, Harris ran his own brokerage offices in Los Angeles until his death there. With his passing, a local music paper declared that "Harris was a rare connoisseur of the art and science of organ building and may justly be termed the father of organ building in the West."

JIM LEWIS

HARRIS, RENATUS (RÉNE) (CA. 1652–1724)

English organbuilder of Breton birth. Renatus Harris was born to Catholic English parents in exile in Brittany—Thomas Harrison and Katherine, daughter of the organbuilder Thomas DALLAM. The family returned to England upon the Restoration and was reestablished in the trade by January 1662; the family soon changed their name from Harrison to Harris. Renatus Harris married Joan Hiett in 1677; their son John Harris (after 1677–1743) continued his father's trade. Renatus Harris retired to Bristol in or before 1722 and died in November 1724. He must have prospered, as he was prepared to pay a £1,000 dowry for his daughter Abigail.

Harris's Catholicism helped fuel the rivalry with the Protestant Bernard SMITH, which reached its peak in "the battle of the organs," a competition to build an organ for the Temple Church in London. In February 1682 each builder was asked to provide an organ, the instruments to be judged and the best one to be erected in the church. By June 1685 both builders' instruments were erected in the church and were played by the leading organists. Smith's was judged the best and a bill of sale was signed with the Middle Temple for the organ on 21 June 1688.

Lawyers and legal disputes were not strangers to Harris. In 1677 he was convicted by the King's Bench of trying to shift the paternal responsibility for a child onto a Mr. Jacobson. In 1702 he made an unsuccessful attempt to a student lawyer of the Inner Temple marry his daughter Abigail after having a child by him. He sometimes made his own instruments unplayable in an attempt to extract payment for them.

Harris built at least seventeen new organs, repaired or restored at least fourteen others, and worked in more than sixty cathedrals and churches. He first worked with his father Thomas, for example, at Worcester (new organ, 1666) and Gloucester (1673). Harris first worked on his own in 1681 (St. Dunstan, Stepney). New organs by him include: Cambridge, King's College, 1686 (enl. 1688, 1695, 1710); London, Christ Church, Newgate Street, 1690; Bristol, Temple Church, 1709; Salisbury Cathedral, 1710 (four manuals); Bristol, St. James, 1719; and London, St. Dionis Backchurch, 1724, (3/24). He proposed a six-manual instrument for London, St. Paul's Cathedral (ca. 1712; unbuilt). He performed extensive rebuilds of organs at Salisbury Cathedral, 1688 (2/18), Norwich Cathedral, 1689 (3/23), and Oxford, Magdalen College, 1690 (2/13).

While Smith built in his "English" style with German and Dutch accents, Harris's Breton background led to a greater French influence in his instruments' tonal dispositions. The St. Dionis Backchurch organ, for example, had a specification of twenty-five stops included eight reeds and a vigorous and bold chorus with prominent mutation and mixture stops. Harris also developed a mechanical device known as "communication," used at Salisbury Cathedral, which made the stops of one manual playable on another.

DAVID S. KNIGHT

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HARRISON, G(EORGE) DONALD (1889–1956)

English organbuilder, active in the United States. Born in Huddersfield on 21 April 1889, Harrison studied at Dulwich College, where he learned to play the organ, and worked for his father as a patent attorney upon graduation. After serving three years in the Royal Air Force during World War I, he entered the firm of Henry WILLIS and Sons, becoming a director in 1921. Among the important Willis instruments Harrison worked on were those in Liverpool Cathedral and Westminster Cathedral in London.

American organbuilders were becoming interested in British tonal concepts in the 1920s, and in 1927 Harrison accepted an offer from the prestigious Ernest M. SKINNER firm in Boston, becoming assistant general manager of the firm. Although Skinner and Harrison differed on significant points of tonal philosophy, they collaborated successfully on several large organs built around 1930, including those for Hill Auditorium, University of Michigan, Ann Arbor, and the chapel at Princeton University in Princeton, New Jersey. Harrison's designs were at first thoroughly British, but in addition to introducing some characteristic Willis flute and reed stops to America, he propagated a balanced principal chorus and brilliant reed stops. His work attracted the interest of influential younger organists who desired a more eclectic instrument than the strongly orchestral type that had built Skinner's reputation a decade earlier.

In 1932 Arthur H. Marks, owner of the Skinner company, purchased the foundering ÆOLIAN COMPANY, renaming the merged firm the ÆOLIAN-SKINNER ORGAN COMPANY. Harrison became technical director of this new firm shortly afterward. Skinner's activity was severely curtailed, and he left to found a new business in 1935, leaving Harrison in charge of all design and tonal policies. Harrison, by this time interested in the European ORGAN REFORM MOVEMENT, began experimenting with German Baroque flutes and French reeds. These new ideas were first applied to organs at Boston, Church of the Advent (1933), Worcester, Massachusetts, All Saints (1934), and the Groton School in Groton, Massachusetts (1936). These instruments combined English, American, and continental tonal concepts into an eclectic disposition that was eventually labeled "American classic," although its foundation was at this time strongly Anglo-American.

In 1937 Harrison went further, building a two-manual "experimental" organ (2/25) that, although employing standard electro-pneumatic action and standard pipe scales, had a stoplist based on German Baroque models and entirely unenclosed pipework. E. Power BIGGS persuaded him to place it in the hall of the Busch-Reisinger Museum in Cambridge, Massachusetts, and used it extensively for recitals, recordings, and broadcasts until 1958. Other organists attracted to Harrison's work on these lines were Carl Weinrich and Ernest White, both of whom commissioned severely "neo-baroque" studio organs from Harrison. Harrison, however, seems to have preferred to incorporate the results of these experiments into more eclectic schemes when size permitted, such as New York, St. Paul's Chapel, Columbia University (1938), with BRUSTWERK and POSITIV divisions containing Baroque-style flutes and reeds alongside more mainstream tonal components.

Although World War II interrupted the progress of Harrison and other leaders in American organ reform, a new generation of organists had been exposed to European organs at its conclusion; these performers continued to encourage the trends of the prewar period. Harrison consolidated his ideas about the American classic organ during the 1940s, and was soon overseeing important organs that put these ideas into practice, including those in the Methuen (Massachusetts) Memorial Music Hall (1947); Salt Lake City, Mormon Tabernacle (1948); and Boston, Symphony Hall (1949).

During the early 1950s Æolian-Skinner became, largely due to Harrison, the builder of choice for large urban churches (Boston, Christian Science Mother Church, 1952; New York, Riverside Church, 1955) as well as universities and concert halls throughout the country. With a heavy backlog of work, Harrison, now president as well as tonal director, was under intense pressure. Working overtime to complete the tonal finishing of the organ at New York, St. Thomas, he succumbed to a heart attack on 14 June 1956.

Along with the work of Walter HOLTKAMP, Harrison's "American classic" concept was widely copied during the ensuing decades, and found a resonance overseas. Although superseded by neoclassical aesthetics in later years, this eclectic concept still exerts some influence on American organ building at the turn of the twenty-first century.

BARBARA OWEN

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HARRISON AND HARRISON

English organ-building firm. Thomas Harrison (1839–1912) established his organ-building company in 1861 in Rochdale, and moved it to Durham in 1872, where he was joined by his brother James. The firm quickly established a reputation for meticulous craftsmanship, and a number of Harrison and Harrison organs from this period are still in good working order. But it was not until Thomas's sons Arthur Harrison (d. 1936) and Harry Harrison joined the company in 1896 that the firm began to achieve greater recognition; the brothers were in sole control by 1912. With Harry designing the organs (under the influence of George Dixon), and Arthur becoming a voicer of legendary vision and perfectionism, the company made its name with an outstanding series of organs, most famously in Westminster Abbey (1937; 4/84; rest. 1987); Durham Cathedral (reb. 1876–77 Willis organ; 1905, 1970; 4/98); and the Royal Albert Hall (1924–33; 4/143). Between 1904 and 1939 Harrison and Harrison rebuilt no fewer than nineteen of England's cathedral organs. Cuthbert Harrison (d. 1991), Henry's son, became managing director in 1945; he was succeeded by Mark Venning in 1975. In 1996 the firm moved to new quarters in Meadowfield, Durham.

The warm and exquisitely blended tone perfected by Arthur Harrison has remained the central characteristic of the firm's work, after more than a century. New organs include Leighton Buzzard (1989; 3/36; tracker), Twickenham (1996; 2/20; tracker), Chestertown, Maryland (1993; 2/23; tracker), Wales, St. David's Cathedral (2002; 4/54; electro-pneum.), Burlington, North Carolina (2002; 3/55; electro-pneum.), and Copenhagen, St. Alban's (2004; 2/21; tracker). The firm's recent restoration work includes King's College, Cambridge (1991) and cathedral organs in Peterborough, Salisbury, Winchester, Southwark, Westminster Cathedral, and Melbourne (St. Paul's).

HARRISON AND HARRISON

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HARROLD, GREG (B. 1955)

American organbuilder, specializing in restoring antique organs and building historical-style organs. Born in Los Angeles on 14 April 1955, Harrold worked with ABBOTT AND SIEKER in that city for three years and with John BROMBAUGH in Eugene, Oregon, for one year. In addition to his training in these shops, several journeys to study instruments in Germany, France, Italy, and Spain influenced his approach to organ building.

In the ensuing years Harrold has restored, designed, built, or voiced a number of distinguished instruments in California, each unique in style. For the University of California–Berkeley he has restored two eighteenth-century German chamber organs, one anonymous, the other by Ibe Peters Iben, and built two new instruments, one with nineteen stops in eighteenth-century North German style, one with fifteen stops in eighteenth-century Spanish style. The Spanish-style organ is the first of its kind built in the United States.

Harrold has built small instruments for Temple Sherith Israel, San Francisco, and Saint Matthew's Episcopal, Pacific Palisades, California as well as continuo organs for the University of California–Los Angeles; University of California–Santa Cruz; Saint Mary Magdalen, Berkeley; and the Lawrence Moe residence in Alameda, California.

LAWRENCE MOE

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HASKELL

Family of American organbuilders. Charles S. Haskell (1840–1904) worked in the Philadelphia plant of the Roosevelt Company, where he and Hilborne L. ROOSEVELT patented pneumatic ventil and membrane-chest designs in 1885 and 1886. After the Philadelphia plant closed in 1891, Haskell opened his own workshop in 1893, continuing to develop chest and action designs.

His older son, William E. Haskell (1865–1927), worked with his father until 1901, when he left to join the ESTEY Organ Company as factory superintendent, a position he held until overtaken by a serious illness in 1924. During his employment with Estey, he developed the "short-length Diapason," later known as the HASKELL BASS, in which the air column of a short-length pipe is divided longitudinally by inserting a second, smaller-scaled tube or chamber in the interior; this generates a sound equivalent to a pipe twice the original's length. Haskell described the effect: "The inserted tube or complementing chamber in the pipe is such a length as to complete the full length of the pipe. . . . The effect is to produce a vibration [oscillation, frequency] that would be obtained with a full-length pipe and in no way does it interfere with the quality of tone. In fact, it assists the pipe materially in its speech." Haskell, in addition to being an exceptional voicer, patented several varieties of flue pipes designed to imitate orchestral reed instruments, including the Oboe, Saxophone, Clarinet, and Gamba Tuba.

Charles's younger son, Charles E. Haskell (1878–ca. 1928), continued the original Haskell firm until bankruptcy closed it in 1921.

See also **Haskell Bass**

DOUGLAS E. BUSH

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HASKELL BASS

A bass pipe patented (1910) by American William E. HASKELL so that organs with limited space (in homes and smaller churches) could play pitches in the lowest registers (e.g., 32'), the piping of which would otherwise extend far past the ceiling.

In the Haskell bass's most common form, a cylindrical tube or canister (usually zinc, occasionally wood) is placed inside of an open metal (sometimes wooden) pipe with its closed end up; it is attached to that pipe securely and dampened against rattling. The air column of a short-length pipe is divided longitudinally and its pitch becomes an octave lower. In theory, the ratio between the inner cross-sections (areas) of the pipe and tube should be 2:1, producing an outside diameter ratio of 7:5 (pipe to tube); however, in reality many Haskell basses vary from this "norm."

The length of the inner tube depends on the register that its pipe will sound as a result of "Haskelling." If an 8' pipe sound is desired, a Haskelled 4' pipe requires a tube of about the same length (or slightly less) to produce the effect. For lower registers, the effect of the Haskelling is such that a pipe a bit larger than half the size of the pipe being substituted for produces a pitch within the desired register; for example, a 32' pitch might be produced by an 18' pipe with Haskelling. (This is another case where Haskell's own theories proved too constraining; he believed a precise 2:1 ratio was essential.)

Less common forms of the Haskell bass include: an open pipe capped by a tube (closed end up; used for a reedless Clarinet); a stopped pipe with a tube (open end up) inserted into it (possibly in theory only); and an open pipe with two inner tubes placed inside, one (open end up) inside the other (closed end up). The two-tube form is used to lower the pitch even further.

The phenomenon of the Haskell bass is not fully understood; even the intuitive addition of pipe length is not corroborated by tests that show the air column flowing more or less normally and the air inside the tube stationary. Perhaps the presence of a second "pipe top" is a factor.

A tuning sleeve assembly at the top of the pipe makes tuning possible. The sleeve can be attached to the bottom of the tube; a rod soldered to the sleeve extends past the pipe's top, enabling movement of the tube; or the tube can be attached to a tuning sleeve fixed to the top of the pipe.

The Haskell bass is generally considered most effective on a metal flue pipe, less so on a wooden flue and, despite experimentation, mostly unsuccessful as a reed pipe. Although applied to 8' as well as 16' and 32' registers, it seems more effective at 16' and 32', partly because of its faster speech when compared to its full-length equivalents. An emphasis on upper partials over the fundamental and relatively soft dynamic level makes String stops most suited for this type of pipe. While the Haskell saved on piping, however, its pressure requirements were above the norm for most smaller instruments; it is now rarely used.

See also **Haskell**

RICHARD KASSEL

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HASTINGS, FRANK

SEE HOOK (AND HOOK; HOOK AND HASTINGS)

HAUPTWERK

(GREAT; Fr. GRAND ORGUE; Dutch *Hoofdwerk.*) The primary DIVISION of the organ since the medieval era;

originally the sole occupant of the main chest above the player (hence Michael PRAETORIUS's term OBERWERK, later applied to different divisions), the term became standard soon after Praetorius. The medieval single-manual organ played the Hauptwerk, while the (perhaps older) POSITIVE was placed in a smaller chest with its own manual behind the player bench and renamed the RÜCKPOSITIV (CHAIR ORGAN). The Hauptwerk combined the ancient BLOCKWERK, a fixed mixture without the capacity to change tone or register, with the SLIDER-effected STOP ACTION of the positive. Even as PEDAL, BRUSTWERK, KRONWERK, and SOLO (RÉCIT) divisions found their way into the main case, and the Rückpositiv was incorporated as the POSITIV, the organ was and is planned around the Hauptwerk's stop disposition (scheme), its pipechest centrally placed and above the player. The classical Hauptwerk has several 16', 8', and (usually fewer) 4' and 2' stops, in addition to mixtures; its tonal basis is the PRINCIPAL (or DIAPASON), surrounded by an assortment of Flutes and other stops (including a few brass reeds).

RICHARD KASSEL

HAUSER, ARMIN (B. 1941)

Swiss organbuilder. Born in Näfels on 13 January 1941, Hauser completed his apprenticeship with the MATHIS Orgelbau in Näfels (1961–65). In 1970 he established Armin Hauser Orgelbau in Kleindöttingen (Canton Argau), where five craftsmen currently work. Since its beginnings, the firm has specialized in traditional, hand-crafted instruments. In addition to influences from northern European organ-building traditions, the historic organs built by the famed BOSSARD family from Baar have exerted considerable influence. The construction methods used in these historical instruments have inspired the workshop's efforts to reproduce the qualities of classical seventeenth- and eighteenth-century organs. All components other than metal pipes are made in the workshop. In the tonal realm, next to the construction and voicing of the pipes, Hauser considers flexible wind pressure a key factor in his instruments, since it lends liveliness to the organ sound and contributes to gentle pipe speech. In the 1990s, the firm increased its work in the care and restoration of Romantic organs. Representative new instruments organs (in Switzerland unless otherwise indicated) include: Leuggern, St. Peter und Paul (1983; 3/44); Hitzkirch, St. Pankratius (1985; 3/40); Leibstadt, Kirche St. Fridolin (1989; 2/20); St. Antoni, Reformierte Kirche (1991; 2/18); Berneck, Reformierte Kirche (1993; 2/31); Wettingen, Klosterkirche (1996; 2/25); Hörzhausen, Germany, St. Martin (1999; 2/15); Bolligen, Reformierte Kirche (2000; 2/22); and Beinwil Freiamt, St. Burkart (2002; 2/22).

DOUGLAS E. BUSH

HAUTBOIS/HAUTBOY

SEE OBOE/HAUTBOIS/HAUTBOY

HAVINGHA, GERHARDUS (1696–1753)

Dutch organist and author. Havingha was born in Groningen, where he was baptized on 15 November 1696 in the Martinikerk, where his father, Petrus Havingha, was organist. In 1722, after four years as organist and carilloneur in Appingedam, Gerhardus Havingha was appointed organist and carilloneur in Alkmaar, where he lived until his death in March 1753.

Havingha is inextricably tied as an adviser to the rebuilding of the van HAGERBEER organ (1645) at Alkmaar, St. Laurenskerk by Franz Caspar SCHNITGER in 1722–25. Schnitger's organ introduced the Hamburg-Groningen style of organ building to the province of North Holland, a region with a different tradition. To counter criticism of the rebuilding, Havingha wrote *Oorspronk en voortgang der orgelen* (Origin and Progress of Organs, 1727), the first book in Dutch about organs. Havingha wrote far more than a defense of the Alkmaar rebuilding; he discusses the history of the organ in general, the organ in the Netherlands, organs in Alkmaar, the history of the main organ in Alkmaar before 1722, the main organ as he found it in 1723, the rebuilding of the instrument as he had proposed it, and a comparison between the old organ and the rebuilt one.

Two organists stung by pointed comments in Havingha's preface, Jacob Wognum and Aeneas Egbertus Veldcamps, each published small books in defense. Wognum said the new Alkmaar organ had been called "a piece of German junk," and he disputed Havingha's choice of equal temperament for the instrument. Veldcamps criticized Havingha as follows: the organ was not "restored" but "remade"; the organ should have had a Hoofdwerk to Pedaal coupler; the Pedaal's Prestant 24' was a silly thing and should have been extended to 32'; the organ should have had a meantone temperament; and slider-chests were inferior to spring-chests. Recent research, however, has suggested that the Schnitger instrument was not tuned to an equal temperament in 1725 and that the relevant criticisms by Wognum and Veldcamps are directed at Havingha's preferences in tuning harpsichords, not the Alkmaar organ.

In addition to his *Oorspronk*, Havingha translated, with extensive commentary, David Kellner's *Treulicher*

Unterricht im General-Bass (1737). Havingha also published a set of keyboard suites in 1725; the suites require a well- or equal-tempered instrument.

James L. Wallmann

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HÉMAN, DE

See De Héman (De Hémen, D'Hémen, Le Héman)

HENCKE, JOHANN (1697–1766)

German-born Viennese organbuilder. Hencke (Henke, Henge, Henkel) was born in Gesecke, Westphalia, where his father ran a woodworking shop linked to a number of regional organbuilders. Correspondence indicates a collegial relationship with Andreas Silbermann dating from 1717 on.

Hencke is known to have been active in several northern and central German cities before arriving in Vienna around 1724. Influences from these experiences are traceable in Hencke's work, although he embraced the building style prevalent in Vienna and throughout much of the Hapsburg empire. Principal characteristics of this mid-eighteenth-century regional style include relatively small one-and-two manual and pedal organs (larger instruments were limited to a few urban and monastic churches); freestanding, compact consoles; cultivation of complete, brilliant, silvery Principal choruses; few reed and mutation stops; cultivation of character stops, such as Salicional, Gamba, and Dulciana; and ornate, divided cases, usually surrounding a large gallery window.

While Hencke's organs embodied the Hapsburg style, he maintained greater integrity in balanced choruses and fewer character stops. For example, his largest organ—Stift Herzogenburg, dating from 1749—presents a Hauptwerk of 16.8.8.8.8.4.4.4.3.2.III.VIII. V, compared with Gottfried Sieber's organ for Vienna, Michaelerkirche (1714), with a Hauptwerk of 16.8.8.8. 8.8.8.4.4.4.3.2.2.1-1/3.I.II.VI.III. Furthermore, the Stift Herzogenburg organ has two Rückpositiv mixtures and a Krummhorn 8', exceedingly rare at this time in Austria; Sieber's Rückpositiv has a single mixture and an 8' Oboe, a more typical choice.

In addition to tonal schemes with more traditional balance than some of his contemporaries, Hencke utilized important technical innovations. He was one of the few builders (if not the only) to divide registers at c' and c♯' between cases; most of his colleagues placed the Hauptwerk on one side, Pedal on the other. Hencke's design allowed for a shallower case and better projection. Furthermore, he took the trouble to construct double sliders, joined at the ends, to counteract sticking when the wood "bowed" due to humidity changes.

Also noteworthy are Hencke's case design, division placement, and console location. Following the emerging Austrian penchant for divided, window-surrounding cases, his work forms a real bridge to the Rococo. His cases are usually joined by a colorful, arching bow, imitated in smaller design by the Rückpositiv. This latter division is often given a *Y* shape, echoing the main cases. Visual access to the altar is thus assured along with a pleasing total aesthetic shape. At least two organs, Herzogenburg and Maria Taferl, utilized double two-story Rückpositiv divisions. Consoles are almost always detached, reversed, and very compact, affording maximum use in continuo practice and in monitoring liturgical action.

Organ building in Austria and much of the Hapsburg empire reached a high point of style tonally and visually during the mid-eighteenth century. Hencke was the leading and most influential Viennese builder in his day; his case style, internal layout, and tonal provision are considered the summit of Austrian design in the 1750s and 1760s. Extant or partially extant examples of Hencke's organs are found at Stift Herzogenburg, Friedhofskirche in Horn, and Maria Kirkbüchl bei Willendorf, all in Lower Austria. A complete list of organs may be found in Haselbock and Kasling.

KIM KASLING

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HENDRICKSON ORGAN COMPANY

An organ-building firm founded in 1961 by Charles Hendrickson. In 1964 the company began its full-scale production of pipe organs and eventually (1970) built a shop in St. Peter, Minnesota; the shop has been enlarged twice since then. Hendrickson, born in Willmar, Minnesota, in 1935, is chief executice officer and president; his wife Birgitta Hendrickson is vice president. The firm employs nine in all the crafts of organ building.

The firm has built over eighty instruments, both tracker and electric action pipe organs. Important Hendrickson organs (in Minnesota unless indicated) include Decorah, Iowa, Luther College, 1971 (2/36 [ranks]; tracker), St. Peter, First Lutheran, 1979 (2/43; tracker), Owatonna, St. John Lutheran, 1976 (3/51; electric), Rochester, Unitarian-Universalist Society, 1979 (2/24; tracker), St. Paul, Church of St. Mark, 1979 (3/46; electric), Minneapolis, St. John's Lutheran, 1983 (3/47; electric), and Sioux Falls, South Dakota, Cathedral of St. Joseph, 1991 (3/62; tracker).

Hendrickson was the first builder in the northern Midwest to build tracker organs in modern times, and the first to document Minnesota's historic pipe organs. He is also an active and lively speaker on organ topics. The thrust of his firm's organ design is toward an eclectic approach suitable for both church worship and academically oriented instruments. Hendrickson seeks great diversity in instruments, rarely repeating concepts or tonal results. The firm aims at particular concepts of musicality to the exclusion of mass production and high efficiency.

CHARLES HENDRICKSON

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HÉNOCH (ENOCQ), ÉTIENNE (D. 1682)

French organbuilder. Nothing is known about his birth or place(s) of residence. Hénoch is first associated with the rebuilding of the organ at Reims Cathedral (1647), although this may have been an older relative. The noted composer Jean Henri D'Anglebert was the organist for Paris, Église des Jacobins, rue Saint-Honore, when Hénoch was commissioned for a new organ (1660); the instrument was notable for its innovative "double Tierce" stop (wide-scale, 3-1/5'). Hénoch built an organ for St. Merry (1664) and enlarged the instrument at Chartres Cathedral (1666–68). Hénoch repaired the cabinet organ at Paris, Tuileries chapel (1668). In 1654, he married the sister of Robert CLIQUOT, who became his apprentice. In 1679, Hénoch and Cliquot won the commission to build the chapel organ at Versailles Palace, comprising Grand Orgue and *Positif de dos* (completed 1681). Another instrument by Hénoch and Cliquot, built earlier and intended for the chapel's rear gallery, was placed instead in the château chapel.

RICHARD KASSEL

HERZ, DANIEL (1618–1678)

German-born Austrian organbuilder. Although known to have been born in Munich on 4 June 1618, Herz's early years are otherwise obscure. A church record dated July 1641 lists him as an "organbuilder from Munich," but the southern Tirolean city of Brixen (now Bressanone, Italy) appears to have been his residence by June 1641. Between 1641 and 1643 he did extensive renovations of the organ at Pfarrkirche Klausen in the southern Tirol. He married in 1644.

In 1646 Herz was granted citizenship in Brixen as an organbuilder, and in 1651 was further authorized as a cabinetmaker. Apparently prosperous throughout his life, Herz was granted a loan for one thousand florins by the bishop of Brixen in 1653. He received many contracts from the Innsbruck court, another indication that he must have enjoyed considerable recognition. Herz also traveled to Mantua, Italy, under commission by the court on business that likely concerned the building of an organ. By 1656 he was the court organbuilder; he moved to Wilten, then a suburb of Innsbruck. He held this position until the Innsbruck court was dissolved in 1665. In addition to caring for court instruments, he took on outside contracts for repairing and building organs and making appraisals. In 1671 he purchased a large estate near Wilten, on which he built a large organ workshop. During his career he was involved in other activities; he arranged the silver plating of an altar for the Augustinian monks at Neustift bei Brixen, and offered to erect a drainage system for a mine on the Schneeberg near Sterzing (now Vipiteno, Italy) in 1666. He died in Wilten on 28 May or 5 June 1678. Johann Hackhofer (b. Toblach, 4 Apr 1645; d. Wilten, 1688) continued the Wilten workshop by purchasing half of the shop and its equipment in 1678, and then acquiring the remaining half in 1684 from Daniel's son Anton Franz Herz (b. Innsbruck, 21 Feb 1660; d. Bensheim an der Bergstrasse, 8 Apr 1717), whom he had instructed in organ building. Anton Franz Herz then established himself as an independent organbuilder in Bensheim, though none of his instruments are known. Jakob Köck (b. Sillian, 12 Sept 1630; d. Brixen, 4 Mar 1673), who had apprenticed with Daniel Herz, set up his own workshop in Brixen in 1660. One of Köck's organs (2/23) survives in Overvellach, Carinthia, Austria.

Daniel Herz was the most important Tirolean organbuilder of his time. Most of his instruments were small organs for village churches; a typical organ was built for Toblach (1662) with the following stops: Copul 8', Principal 4', Super Octaff 2', Spitzflaut 2', Quint 1-1/2', and Tremulant. In the choir organ in Wilten, Stiftskirche (1676; extant), he employed an extension system enabling him to take three stops with sixty-nine pipes each and make the following pitches available: 8.4.2.2-2/3.1-1/3'.2/3'.1'.1/2'.1/4'. That Herz was contracted for a sizeable organ in the cathedral of Belluno, Italy (1665), and for an organ in Jerusalem (no date given) suggest his considerable reputation and renown.

Maximilian Zweimüller

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HESS, HENDRIK HERMANUS (1735–1794)

Dutch organbuilder of German background. Hess was born in Leeuwarden on 10 October 1735; his parents had moved there from Grünstadt, near Worms. When his brother Joachim Hess was appointed organist of the Jacob François Moreau organ at the St. Janskerk in Gouda in 1754, he encouraged Hendrik to move there and become an organbuilder. Since Hendrik had no experience in this area, Joachim bought the necessary tools and books on organ building, and hired several craftsmen to show his brother various techniques. They finally employed a "German mate, capable in every respect" (probably Johannes Josephus Mitterreither, 1733–1800) to teach Hendrik the remainder of his craft. In later years, Hendrik employed Johann Caspar Friederichs and probably Johannes Pieter Künckel (1750–1815).

In 1761, Hess built an organ for Bodegraven, Reformed (case extant); the instrument was criticized for not having enough capacity to accompany the congregation. Details in the construction of the organ for the Walloon church in Schiedam (1773; now in the Stedelijk Museum, Amsterdam) also suggest that Hess was not the best of church organbuilders. As a builder of house organs, however, Hess was more prolific than any other Dutch builder; he built dozens of instruments, many of which survive. They vary greatly in size (from three stops to two-manual instruments with up to thirteen stops) and quality; some instruments show a somewhat careless finishing, while others show a high level of craftsmanship. A bureau organ (1772; 1/7), now in the Gemeentemuseum, The Hague, has a piano lever for switching on and off the smallest pipes. Many other organs can be found in small churches and private collections.

From 1780 until his death on 29 July 1794, Hess maintained the Müller organ at St. Bavo's, Haarlem, changing the Rugwerk Cymbel into a more fashionable Carillon in 1783. In 1791, he moved the old organ (van Covelens, 1523) of St. Bavo's to Haarlem, Nieuwe Kerk, adding a new Bovenwerk in late eighteenth-century style (8.8.4.2.1.8).

Jan-Piet Knijff

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HESS, JOACHIM (1732–1819)

Dutch organist and author. Hess was born in Leeuwarden on 24 September 1732. When only seventeen years of age, he received the appointment as organist at the Lutheran church in Gouda, the city in which he spent all but a few months of his professional life. In January 1754, after only two months as organist of the Grote Kerk in Maassluis, Hess was appointed organist of St. Janskerk, Gouda. During this time, he brought his younger brother Hendrik Hermanus HESS to Gouda, where Hendrik learned to build organs under Joachim's supervision. Joachim held the Gouda position for over fifty years until poor health led to his semiretirement in 1805. In 1813 Hess retired completely and moved to Zeist, where he lived with the Moravian brethren, a community he had joined many years earlier after dissatisfaction with the Lutheran and Dutch Reformed congregations.

Joachim Hess is remembered today as an author of books on music and the organ. His *Korte en eenvoudige handleyding*, a primer on organ and harpsichord playing, appeared in 1766 and went through many editions. *Luister van het orgel* (1772) was a book on registration, much of it illustrating the organist's own practice on the Jacob François MOREAU organ at Gouda, St. Jan's. The registration examples are in a galant and imitative style. A companion to *Luister van het orgel*, *Dispositien der merkwaardigste Kerk-Orgelen* (1774), was a book of specifications for Dutch and foreign organs. Inspired by German works he knew, Hess took the specifications from his own observations, correspondents, and German books: principally Jacob ADLUNG's *Musica Mechanica Organoedi* (1768), but also Michael PRAETORIUS (1619), Johann Mattheson (1721), Friedrich Wilhelm Marpurg (1758), and the *Sammlung einiger Nachrichten* (1757). *Dispositien der merkwaardigste Kerk-Orgelen* also has a list of stop names, three sample organ contracts, a specification for an organ with ninety-nine stops, and a description of the St. Jan's organ. A manuscript of Hess from around 1815 contains specifications of other Dutch instruments. Nicolaas Arnoldi Knock's own *Dispositien der merkwaardigste Kerk-Orgelen* (1788), with specifications of instruments in Friesland and Groningen, was directly inspired by Hess.

Hess wrote two other books. *Over de vereischten in eenen organist* (1807) is in the form of a dialogue between master and pupil and distills the life experience of Hess as church and concert organist, carilloneur, music teacher, organ tester, and expert of the organ and carillon. *Korte schets* (1810) is an abbreviated compilation of material from earlier German and Dutch books on the history of the instrument. He died in Zeist on 27 December 1819.

JAMES L. WALLMANN

Writings

Dispositin der merkwaardigste Kerk-Orgelen (1774)
Korte en eenvoudige handleyding (1766)
Korte schets (1810)
Luister van het orgel (1772)
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HEURN, JAN VAN (1751–1815)

Dutch organmaker and scholar. Born in 's-Hertogenbosch (chris. 7 Mar 1751), van Heurn's education included less than a year's legal training at the university in Utrecht (he would later serve as a professor of law at a local school). From 1780 until his death, van Heurn held various positions in local and regional governments and courts. He was a member of the Wallonian church council in 's-Hertogenbosch and served as an organ consultant. He died in his native city on 19 March 1815.

It is as the author of *De Orgelmaaker* (1804–5) that van Heurn is remembered. *De Orgelmaaker* was strongly influenced by the great French treatise of François BÉDOS DE CELLES, *L'art du facteur d'orgues* (1766–78), but van Heurn's volumes are not a translation of the French work, as is sometimes claimed.

Van Heurn's work has a more logical arrangement than the French work, while there are topics covered by Bédos de Celles not mentioned by van Heurn. In more than one hundred references to Bédos de Celles in *De Orgelmaaker*, van Heurn sometimes depended on the French book when it discussed a topic about which he knew little, but he also expressed a difference of opinion with Bédos de Celles at times.

Despite his admiration for the treatise of Bédos de Celles, van Heurn had very little understanding or appreciation of the French organ. Furthermore, he had no firsthand experience with the organs of the northern provinces of the Netherlands or northern Germany and was not aware of organ-building practices outside his region, although he clearly did have practical experience with building organs. *De Orgelmaaker* is thus not a "compendium" of Dutch organ building of the late eighteenth century but an knowledgeable amateur's view of the craft, based on local practices. Most Dutch organbuilders of the nineteenth and twentieth centuries were familiar with van Heurn's treatise; the autodidact Franciscus Cornelius SMITS (1800–1876) even learned the craft from the work. No book in Dutch since *De Orgelmaaker* has approached it in scope or thoroughness.

JAMES L. WALLMANN

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HEUSS

German organ-parts manufacturer. Otto Heuss (1895–1965) learned organ making with Mönch in Überlingen. In 1929, he became foreman at Förster and Nicolaus in Lich (Hesse), where, in 1953, he established a workshop for organ console making, at first only with electric action. His son Otto (1925–2000) also studied with Förster and Nicolaus, and eventually joined his father's business.

The first mechanical console chassis was developed by Heuss and manufactured in 1961. Over the years, slide-action motors, combination setting systems, carillons, and Zimbelsterns have been manufactured. Stefan-Otto Heuss (b. 1964), grandson of the company founder, learned with Werner Bosch in Kassel and worked in the United States. He joined Heuss in 1986; since 1990, Stefan-Otto has headed the company. While expanding its product range, the firm's focus remains the making of mechanical and electric consoles with combination systems, transmission systems, coupler systems, tracker components, and electric action parts.

CHRISTOPH KEGGENHOFF

HEUVEL, VAN DEN

Dutch organ-building firm. Jan Leendert van den Heuvel (b. Dordrecht, 5 Nov 1946), the son of a painter, apprenticed with D. A. FLENTROP. He set up his own workshop in Dordrecht (1966), and built his first major organ for Ridderkerk, Singelkerk, 1972 (3/32). His brother Peter Aart van den Heuvel (b. Dordrecht, 13 Feb 1958) joined the workshop in 1979; the firm became J. L. van den Heuvel-Orgelbouw B.V. Unlike most of its competitors, which followed the neobaroque path, van den Heuvel was inspired by the symphonic organ, especially that of Aristide CAVAILLÉ-COLL. The firm built a number of two-manual instruments in preparation for its "breakthrough" organ at Karwijk-aan-Zee, Nieuwe Kerk (1983; 4/80). Although received with controversy in the Netherlands, the instrument appealed to French organists, who recognized that a Dutch firm could build large neoromantic organs. This led to the commissioning of a new organ in an old case at Paris, St. Eustache, 1989 (5/101), the largest in France, featuring five 32' stops, 33 windchests, mechanical/electric action, and a second remote control console with MIDI (musical instrument digital interface) capacity. This mixture of nineteenth-century tonal design and late-twentieth-century technology typifies van den Heuvel's philosophy of modeling, not imitating, French symphonic instruments.

The firm remains best known for its neoromantic approach, as found in organs at Geneva, Victoria Hall (1992; 4/17); London, Royal Academy of Music (1993; 2/24); New York, Holy Apostles (1994; 3/32, orig. Fairview, TX; rest. 2000); Munich, St. Franziskus (1997; 3/51); Stockholm, St. Catherine (2000; 3/62); Mänttä, Finland (2003; 3/30); and Copenhagen, Danish Radio and TV (due 2006; 4/87). Van den Heuvel continues to build in its homeland (Leerdam, Reformed Diocese, 1989/2000, 2/16; Opheusden, Reformed Diocese, 2001, 2/29; Breda-Princenhage, Reformed, 2003, 2/12); the firm restores instruments (Breda, Notre Dame Cathedral, anon. 1712/Flentrop 1966, 2000, 4/53) and builds house organs (Bellville, TX, Castle Creek, 1/4).

RICHARD KASSEL

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HILDEBRANDT

German organ-building family. Zacharias Hildebrandt (1688–1757) was an organbuilder in Leipzig. He apprenticed (1713–18) with Gottfried SILBERMANN, who was only five years his senior, and came to be recognized as Silbermann's most distinguished pupil. In 1723 Hildebrandt built the organ for the church in Störmtal, south of Leipzig, an instrument that Johann Sebastian Bach dedicated in November of that year. The friendship and professional collaboration that grew between the two men resulted in Hildebrandt's settling in Leipzig in 1734.

In part due to Bach's recommendation, Hildebrandt was awarded the contract to build the organ in the Naumburg Wenzelskirche (1743–46, 3/53; rest. Eule, 1994–2000), the design of with which Bach seems to have been involved. About this organ Jacob ADLUNG wrote, "It is a successful instrument, whose beautiful tone can scarcely find an equal." Hildebrandt may be considered the organbuilder with whom Bach was most closely involved during the later years of his career. In 1750 Silbermann, having just been given the contract to build the Dresden court church organ and sensing the onset of old age, contracted with Hildebrandt to supervise the building of that instrument (1750–55, 3/47).

Zacharias's son, Johann Gottfried Hildebrandt (1724–1775), built organs and other keyboard instruments. He apprenticed and worked with his father during the building of the Naumburg Wenzelskirche and Dresden organs. After completing the organ begun by his father in the church at Dresden-Neustadt (1757; 2/38; destr. 1945), Johann Gottfried moved to Hamburg, where he won the contract to build the organ for St. Michael's (1762–69, 3/60).

DOUGLAS E. BUSH

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HILL, WILLIAM (HILL AND SON)

English organ-building firm. William Hill, his son Thomas, and his grandson Arthur George led a firm known successively as Elliot and Hill, William Hill, Hill and Davison, Hill and Co., and Hill and Son.

Nothing is known of the career of William Hill (chris. Spilsby, Lincolnshire, 19 Nov 1789; d. 19 Dec 1870) until he joined Thomas ELLIOT's workshop in Tottenham Court, New Road, London (ca. 1815). Elliot's foreman was Alexander Buckingham, but by 1818 Hill was being given "the whole credit" for an ingenious mechanical layout for the new organ in the Ashridge chapel. In the same year Hill married one of Elliot's daughters and so ensured his succession to the business. He became Elliot's partner around 1825, after which the business was known as Elliot and Hill.

His work falls into three phases. In the first phase (1825–38), Hill attempted to increase the versatility and power of the organ by expanding Swell divisions, increasing pipe scales, duplicating chorus registers, introducing 16' and 32' Pedal stops, and extending keyboard compasses to FF or CC. He also experimented with the scaling and voicing of reed stops, adopted the Cornopean (Swell) and Posaune (Great) as preferred chorus registers, and in 1840 added the world's first high-pressure reed to the Birmingham Town Hall organ (orig. compl. 1834). This organ and one for York Minster (1829–33) were built on a scale unprecedented in English practice and presented technical challenges that were only partly overcome. The key touch of both organs was excessively heavy, and contemporaries were disappointed by the lack of power from organs with 32' pedal pipes and (respectively) forty and fifty-four stops. The firm's organ for King College, Cambridge, was first built in 1834 using the Thomas DALLAM/Renatus Harris case; it would supervise rebuilds in 1859, 1889, and 1911.

The second phase of Hill's work (1838–56) was concerned with the development of the "German System" organ. Under the influence of Frederick Davison (a partner in 1837–38, later part of GRAY AND DAVISON) and then H. J. GAUNTLETT, Hill developed an organ that represented a radical departure from the older English style. In adopting CC-compasses, independent Pedal divisions, 16' manual choruses, large Swell divisions and a palette of novel flute, string, and reed registers, Hill pursued his quest for an instrument that combined power with musical versatility. Gauntlett wanted to develop an organ that could play both the works of Johann Sebsatian Bach and orchestral transcriptions, a goal Hill attained in the 1840s and '50s. After early experimentation, continuing with the ambitious instrument for Great George Street Chapel, Liverpool (1841–55; reconstr. 1867; 4/100), a concert organ for Edinburgh Music Hall (1843), another large church organ in Ashton-under-Lyne (1845), and culminating in his magnum opus, the sixty-stop concert organ for the Royal Panopticon of Science and Art, Leicester Square, London (1853), Hill produced a style of instrument marking a radical break with the past and laid the foundations for the mature Victorian organ.

Hill's third phase (1856–70) was marked by increasing sophistication of construction and tonal refinement. Limited use was made of the pneumatic lever in large organs, and chorus reeds were placed on higher wind pressures. Metal pipes gained in weight and spotted metal was used for reeds. Soundboards were more generously constructed and the internal layout of Hill's organs became more spacious. Tonally, the adoption of Quint mixtures, wooden Strings, and small-scale GEDECKTS reflects the influence of SCHULZE, with whom Hill collaborated at Leeds Parish (1859), although affinities with Hill's earlier work are generally clear. Important instruments from this period include London, All Saints, Margaret Street (1859), York Minster (reb. 1859), Cambridge, King's College (1860), St. Albans Abbey (1861), Belfast, Ulster Hall (1862), Sydney Cathedral (1866), Bath Abbey (1868), and Melbourne Town Hall (1870). Hill was working on the drawings for the Melbourne organ until a fortnight before his death.

Hill is regarded as the most significant English organbuilder of his generation, an innovative figure whose career saw the transformation of the late Georgian organ, with its long compasses and conservative tonal schemes, into the mature Victorian organ, with its CC-compasses, independent PEDAL sections, large SWELL divisions, and mechanical complexity. The achievements of the next generation of builders (such as Henry WILLIS and T. C. LEWIS) were heavily indebted to Hill's pioneering efforts.

Thomas Hill (b. 8 Jan 1822; d. 22 Oct 1893), son of William Hill, was taken into partnership around 1856, creating Hill and Son. Temperamentally, he was conservative, and the organs built during his management of the firm did not differ greatly from those of the 1860s. Strings became more common, and the number of accompanimental and solo voices increased, but a wind pressure of 3" remained standard and a classical balance between flue and reed choruses was preserved. Thomas Hill was more innovative in mechanical matters. Tubular-pneumatic action was normal for large organs by the mid-1880s, and the firm experimented, not altogether successfully, with electric action (Stratford-upon-Avon, 1888). A console design was developed with angled jambs, ivory knobs, and a generous provision of accessories.

In 1886 the firm won the contract for Sydney Town Hall. With five keyboards, 127 stops, 45 ranks of mixtures, and a 64' reed, it was the world's largest organ at the time it was inaugurated by W. T. Best in 1890. Other major works included Manchester Cathedral (1871), Worcester Cathedral (1874), Westminster Abbey (1884), Birmingham Town Hall (1890), Peterborough Cathedral (1893), and the Queen's Hall, London (1893).

Arthur George Hill (1857–1923), son of Thomas Hill, was born on 12 November 1857. He studied at Cambridge University, then worked in the office of architect George Gilbert Scott. Hill became a skilled designer of organ cases, including those for Chichester Cathedral (1888), Sydney Town Hall (1890), and Peterborough Cathedral (1904). He published an important two-volume work, *The Organ-Cases and Organs of the Middle Ages and Renaissance,* described in its subtitle as "a comprehensive essay on the art archaeology of the organ, with architectural and historical accounts of the more remarkable organ-cases and organs still remaining in various parts of Europe, giving also lists of stops and other musical notices of interest." The two volumes (1883, 1891) included sventy-two facsimiles of original drawings.

When Arthur George Hill took over in 1893, Hill and Son continued to execute prestigious contracts. The tone of the flue and reed choruses became more opaque, mixtures were less in evidence, and the orchestral tendencies of certain registers became more marked. Tonal finish and mechanical refinement were impeccable. Tracker action remained the norm for smaller organs, pneumatics for larger instruments; electric action was only used for exceptionally difficult locations. During these years the firm's clients included Bangor Cathedral (1897), Middlesbrough Town Hall (1898), Eton College (1902), Lichfield Cathedral (1908), Chester Cathedral (1909), All Hallows, Gospel Oak (1914), and Beverley Minster (1916).

In 1916 Hill and Son amalgamated with NORMAN AND BEARD Ltd. of Norwich to form HILL, NORMAN AND BEARD.

See also **Hill, Norman and Beard, Australia**

NICHOLAS J. THISTLETHWAITE

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HILL, NORMAN AND BEARD

English organ-building firm. The amalgamation of HILL AND SON and NORMAN AND BEARD Ltd. of Norwich in 1916 created W. Hill and Son and Norman and Beard Ltd. Arthur George Hill and George A. Wales Beard were joint managing directors until 1923, when John Christie of Glyndebourne acquired Hill’s majority shareholding. The Christie family retained control of the company until its closure.

Following the amalgamation, Herbert John Norman (1861–1936) worked hard to achieve a synthesis of styles from the two parent companies. Progressive features contributed by Norman and Beard (extensive enclosure, Pedal borrowing, electro-pneumatic actions, orchestral tonalities) predominated, but the firm still attached importance to the development of Principal choruses and interdepartmental balances, much in the Hill tradition (Swansea, Morriston Tabernacle, 1920; Royal Hospital School, Ipswich, 1933).

Another unconventional departure for the firm was the building of the UNIT ORGAN for theaters, known as Christie Unit Organs. At the height of the craze in the late 1920s, the firm was making up to forty instruments a year, varying in size from three or four units to its magnum opus, the four-manual, thirty-unit organ for the Regal Cinema, Marble Arch, London (1928).

Christie’s active interest had waned by the mid-1930s, and the firm came under the artistic direction of Herbert Norman (1903–2001). Beginning tentatively with the inclusion of an eleven-stop POSITIVE at Norwich Cathedral (1939–42) Norman began to refocus the firm’s tonal style. World War II prevented immediate progress, but during the 1950s and ’60s the firm built organs in which classical elements (POSITIV divisions, mutations, cornets, sharp mixtures, EN CHAMADE REEDS) were blended with English registers. Most of these eclectic instruments were fitted with electro-pneumatic actions and a full range of console accessories. They included St. John’s College, Cambridge (1955), Llandaff Cathedral (1958), Hyde Park Chapel (1961), Glasgow University (1962), the Royal College of Organists, Kensington (1967), Leeston, New Zealand, Ellesmere College (1969), and St. Mary, Stafford (1974).

At Gloucester Cathedral (1971) the firm collaborated with Ralph Downes, building what was virtually a new organ inside a seventeenth-century case. The Gloucester organ used an electromagnetic action pioneered by John Norman (b. 1932), who became managing director that year. Three years later he was succeeded by Frank Fowler; during Fowler’s tenure the firm introduced an electronic transmission system with a two-wire coaxial cable, providing the means for a multichannel capture system and recording and playback facilities. Fowler retired in 1992; the firm closed in 1998.

NICHOLAS J. THISTLETHWAITE

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HILL, NORMAN AND BEARD, AUSTRALIA

The Australian branch of the London firm of HILL, NORMAN AND BEARD, established in 1927 following the awarding of contracts for several large organs in Australia and New Zealand. Operating from Melbourne, the firm built eighty-six new organs and rebuilt almost one hundred others. Hill, Norman and Beard (Australia) Pty. Ltd. produced instruments ranging from Romantic-symphonic and theater organs in the late 1920s and 1930s to new instruments and eclectic rebuilds incorporating the tonal concepts of the post-1945 ORGAN REFORM MOVEMENT.

Among the firm’s most significant commissions were the new or rebuilt organs in the Anglican cathedrals of Melbourne (1929), Adelaide (1929), Sydney (1952), and Brisbane (1972). The firm’s largest instrument, for Melbourne Town Hall (1929; 4/110) was the only Australian concert organ conceived in symphonic style, with six enclosed divisions, percussion stops, diaphones, and an Echo Organ at the back of the auditorium on electric action. It survived largely unaltered until 2001, when its pipes and case were incorporated into a new instrument.

Hill, Norman and Beard (Australia) operated branches in Sydney (1929–39, 1955–69) and Christchurch, New Zealand (1927–37). The firm closed in 1974.

KELVIN HASTIE

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HINNERS

American organ-building firm. John L. Hinners (1846–1906) founded the company in Pekin, Illinois, in 1879 to build reed organs and sell pianos. Initially named the Perfection Organ Works, it became the Hinners and Fink Company when J. J. Fink became a partner (1881). Fink was bought out in 1886 by Ubbo J. Albertsen and the firm became the Hinners and Albertsen Organ Company. The manufacture of pipe organs began around 1890; the earliest known installation was at Huntingburg, Indiana, German Evangelical (1892). When Albertsen retired in 1902, the firm incorporated as the Hinners Organ Company; Arthur W. Hinners (1873–1955) became director upon the death of his father. The company had almost one hundred employees in 1912. Approximately ten thousand reed organs had been manufactured by that time, and 3,097 pipe organs were assigned opus numbers by the time the effects of the Depression brought a halt to pipe organ building in 1936. The last years of the firm were spent mainly on repair work and making replacement parts, but reed organs continued to be built until the company was dissolved in 1942.

Hinners pipe organs were mostly built with mechanical action until 1930, although tubular-pneumatic action was first used in 1910. Electro-pneumatic instruments were built beginning in 1916, having either slider-chests with electro-pneumatic pull-downs or a combination of ventil and unit chests; a few attempts of make cone-chests or pitman chests were unsuccessful. Metal pipes from the Gottfried firm of Erie, Pennsylvania, were used until Hinners founded the Illinois Organ Supply Company within its factory in the early 1920s to build and sell its own flue and reed pipes.

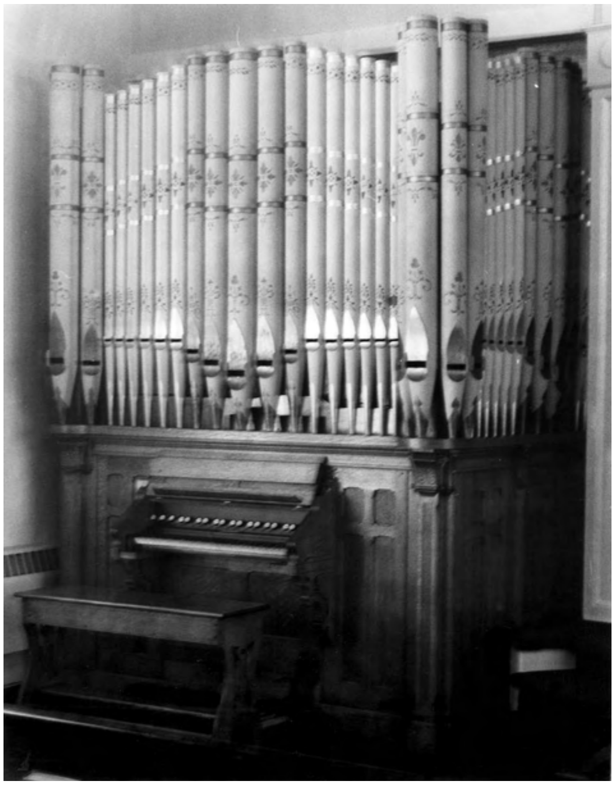

Fig. 47. Hinners organ, Pickens Presbyterian Church, South Carolina; refurbished and installed by Gene R. Bedient Co.

Throughout its existence, Hinners was known for high-quality workmanship at low prices, made possible in part by the fact that no salesmen were employed; stock-model organs were sold via catalogs in English and German, with factory workers making the installation. Many of the instruments had one manual, with stops divided between bass and treble; any reeds were of the labial type. In addition to one- and two-manual organs, some installed instruments were three-manual; two were four-manual. Hinners also built around fifty theater organs. Although the installations were mostly in small Midwestern churches, organs were sent as far away as India, South Africa, and Korea.

ARTHUR LAWRENCE

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HINSZ, ALBERT ANTONI (1704–1785)

Dutch organbuilder of German birth. Hinsz (also Hintz), baptized on 29 December 1704, probably learned his craft in Hamburg; he was living in Groningen by 1728. After the death of Franz Caspar SCHNITGER, Schnitger's widow hired Hinsz to complete the rebuilding of the organ at the Groningen Martinikerk. In 1730, Hinsz built his first independent organ at Zandeweer (extant). A year later, he married Schnitger's widow and merged his workshop with Schnitger's. Hinsz later employed his stepson Franz Caspar SCHNITGER Jr. (1724–1799), who took over most of the maintenance work after 1770 and took over the business together with Hermann Heinrich FREYTAG after Hinsz's death on 17 March 1785.

Many of Hinsz's organs survive, often in good condition, including: Leens, Petruskerk (1734/1757), Utrecht University (orig. for Deventer, Lutheran, 1739), Kampen, Bovenkerk (1743), Appingedam, St. Nicolaaskerk (1744), Wassenaar, Dorpskerk (1769), Midwolda (1772), Harlingen, Grote kerk (1776), Damwoude (1777), and Bolsward, Martinikerk (1781). Like the Schnitgers, Hinsz dealt respectfully with the work of previous builders, often incorporating existing material in his new organs.

Hinsz's earlier work is characterized by a brilliant and powerful sound, the later organs by a full, warmer sound. A special affection for the Nasat 3' is evident. In 1740, Hinsz added a Cornet to the Groningen organ, a typically Dutch feature that became standard in his organs from around 1750 on. At this time, Hinsz started to add a Tierce (often 3-1/5') to his mixtures, and from the mid-1760s the Bourdon 16' takes the place of the Quintadena 16'. Hinsz usually left space for a Borstwerk to be added later; the Borstwerk in the Kampen organ was installed by F. C. Schnitger Jr. and Freytag (1789). Hinsz's influence on Dutch organ building was considerable; in addition to his stepson and Freytag, his pupils included Lambertus van Dam (1744–1820), who added a Rugwerk to the Wassenaar organ, and probably Albertus van Gruisen (1741–1824).

Jan-Piet Knijff

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HINTERSATZ

Ranks of pipes located behind the case pipes of the Blockwerk, sometimes called Hinterwerk. It is a mixture of Principal pipes after the Prestant has been separated off.

HOFMANN, OTTO (1918–2001)

American organbuilder of German background. Born in Kyle, Texas, on 9 December 1918, Hofmann studied physics and music at the University of Texas–Austin (1936–42) and collaborated with C. P. Boner in acoustical research and the rebuilding of older organs. In 1948 he established his own business in Austin, initially doing only maintenance and rebuilding work. His first organ was built in 1956 for Matthews Memorial Presbyterian in Albany, Texas, in collaboration with D. A. Flentrop, who supplied the pipe scales and some of the parts. Other mechanical parts were salvaged from a Hinners organ, and the case was designed by Joseph Blanton and executed by a cabinetmaking firm. This two-manual, nineteen-stop organ is usually cited as the first tracker action organ to have been made by an American builder following World War II. Although this organ was entirely mechanical, many subsequent Hofmann organs employed electro-pneumatic stop action. Hofmann's greatest period of activity was during the 1960s and '70s, during which time he built over a dozen tracker organs as well as several with electro-pneumatic key action. One of his tracker organs was built in 1962 for North Texas State University, Denton; his largest instrument (three manuals) was completed in 1976 for Christ Episcopal, San Antonio. The majority of Hofmann's instruments are found in Texas; he also built organs for locations in Arkansas, Illinois, Louisiana, and Oklahoma. He died in Austin, Texas, on 12 May 2001.

Richard Kassel

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HOHLFLÖTE

A term applied over the centuries to a variety of flute-toned stops. In central and northern Germany around 1500 it was a wide-scaled open metal Flute; in the Rhineland and southern Germany during the next century it was often a wide-scaled stopped Flute; in the Netherlands it might be a Gedeckt, Rohrflöte, or Quintaton. By the nineteenth century, the term *Hohlflöte* had come to mean a wide-scaled open wooden Flute of dull, hollow tone. Since then it is almost always made of open quadrangular wooden pipes, although it can be found as triangular wooden pipes or open metal pipes. By far the majority of examples are at 8' pitch, but it is occasionally found at 4', and rarely at 2' pitch. Synonyms include Hohl Flute, Holpijp, Hohlpfeife, and Flûte Creuse.

See also **Stop**

Edward L. Stauff

HOLBROOK AND WARE

American organ-building firm. The workshop was founded at East Medway (now Millis), Massachusetts, in 1837 by Josiah Holbrook Ware (1797–after 1850), who had apprenticed with William M. Goodrich, and George Handel Holbrook (1798–1875). While Holbrook continued to manage his bell foundry, Ware oversaw the organ workshop, which produced at least two dozen church and chamber organs during the period of the partnership, which ended in 1850.

After 1850 two essentially new companies took the place of the original one. Holbrook's son, Edwin Lafayette Holbrook (1824–1904), trained as a musician, continued the organ business under his own name until his retirement in the 1890s, building organs of modest size. Ware's three sons (William G. Ware, A. L. Ware, and M. A. Ware) were all pipemakers, and although William soon left to study medicine, his two brothers continued to run an independent pipe-making shop until at least 1884 and possibly later, supplying pipes to Holbrook and other Boston-area builders.

Barbara Owen

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HOLTKAMP

American family of organbuilders. The firm that started the Holtkamps' organ-building legacy began life as the Votteler Organ Company (est. 1855), succeeded by Votteler, Holtkamp and Sparling in 1914. Henry H. Holtkamp (d. 1931) had joined the Votteler firm in 1903. After World War I, Walter Holtkamp (1895–1962), his son, joined the firm; he became the company's director in 1931, a position he held until his death. The firm had in the interim been renamed the Holtkamp Organ Company and would become one of the premier organbuilders in the United States.

Holtkamp first gained attention by adding a Rückpositiv with a slider-chest to the large organ at the Cleveland Museum of Art, apparently the first built by an American in the twentieth century. From this, Holtkamp firm began to move from the orchestral organ of Ernest M. Skinner and, with G. Donald Harrison, led the way toward a style later dubbed "American classic." This aesthetic sought an eclectic instrument, useful for several periods and nationalities of organ music; in its day, this represented the first wave of American organ reform.

The essential elements of a versatile Walter Holtkamp instrument, with later developments carried out by his successors, may be described as follows: (1) the development of a new type of electric action incorporated into slider-chests; Walter Holtkamp remained faithful to this system, and tracker action was not incorporated until after 1969 by his son Walter Holtkamp Jr.; (2) the relocation of chests and pipes from chambers into dramatic displays of pipes in completely exposed divisions; beginning in 1964, organs were installed in freestanding cases; (3) the reintroduction of traditional elements of tonal design in dispositions: unison couplers only, principal choruses in each division, reeds in each division, and only one enclosed division (Swell); (4) the avoidance of extension and duplication in stoplists (only exceptions in the Pedal); and (5) the development of a new, streamlined stop-tablet console.

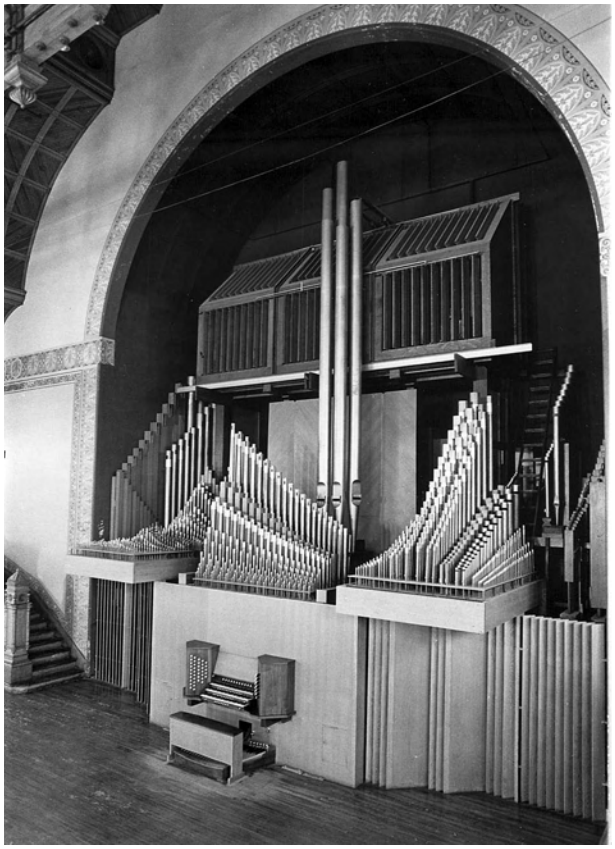

Fig. 48. Holtkamp organ, 1950, Setnor Auditorium, Syracuse University, New York (Photo by William Van Pelt).

The 1952 Holtkamp instrument in St. Paul's Episcopal Church, Cleveland Heights, Ohio, was the defining organ, both visually and in terms of its disposition, in the mature phase of Walter Holtkamp's career. It remains in its original state; a stoplist follows:

Great

Quintadena	16
Principal	8
Flute	8

Bourdon	8
Octave	4
Spitzflöte	4
Quinte	2-2/3
Super Octave	2
Mixture	IV
Scharf	III
Trumpet	8

Swell

Rohrflöte	8
Lieblich Gedackt	8
Gamba	8
Gamba Celeste	8
Octave Geigen	4
Bourdon	4
Aeoline	4
Flautino	2
Dolce Cornet	III
Plein jeu	IV
Basson	16
Fagott	8
Rohr Schalmei	4
Hautbois	8
Clarion	4

Positiv

Copula	8
Praestant	4
Rohrflöte	4
Nazard	2-2/3
Doublette	2
Tierce	1-3/5
Fourniture	III
Cromorne	8

Pedal

Polyphone	32
Principal	16
Subbass	16
Quintadena	16
Octave	8
Gedeckt	8
Choralbass	4
Nachthorn	4
Mixture	III
Cornet	32
Cornet	16
Posaune	16
Trumpet	8
Schalmei	4

At first, the company continued working in the manner Walter Holtkamp established; the firm expanded under Walter Holtkamp, Jr., from 1962, until 1995, when his son F. Christian Holtkamp was named president. The firm builds three or four meticulously constructed organs a year.

James H. Cook

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HOLZHAY

German organ-building family; also spelled Holzhey. Alexander Holzhay (b. Rappen, Upper Swabia, 30 Sept 1722; d. Tussenhausen, 25 Mar 1772) worked with Augustin Simnacher (1688–1757), in Tussenhausen-Angelberg, and succeeded him in 1754, the same year he married Simnacher's daughter. Work on the cathedral organ in Brixen (now Bressanone, Italy; 1756–58) was in progress when Simnacher died; Holzhay, along with Simnacher's son Joseph Antoni Simnacher (1722–1796), finished the organ. In 1760 the two teamed together again to build the double organ in the Augustinian abbey of Neustift. Holzhay continued to direct the business in Tussenhausen, while Simnacher moved to southern Tyrol permanently. Holzhay's organs include a number of 8' and 4' stops and typify the "gallant" style; among his instruments are those at Wettenhausen (1760) and Hammerstetten (1763).

Franz Xaver Holzhay (1757–1821), son of Alexander Holzhay, probably learned organ building from his father. In 1781 he married the daughter of organbuilder Johann Baptist Kronthaler in Kaufbeuren, then moved to Kaufbeuren to take over the workshop there.

Johann Nepomuk Holzhay (b. Rappen, 26 Feb 1741; d. Ottobeuren, 18 Sept 1809 in Ottobeuren), a nephew of Alexander Holzhay, likely apprenticed with him. He worked as an apprentice and colleague of Karl Joseph Riepp in the building of the famous organs in Ottobeuren. In 1766 he married the daughter of the organbuilder Joseph Zettler; he acquired his father-in-law's organ shop in Ottobeuren and brought that firm to its zenith. A second marriage added four daughters and seven sons to his family.

Along with Riepp and Joseph Gabler, Johann Nepomuk Holzhay was the most important organbuilder. Holzhay's instruments (around twenty-seven altogether) may be regarded as somewhere between the styles of Gabler and Riepp, a combination of South German and French traits. Some of his most important organs include Ursberg (1776; 2/26), the main organ in Obermarchtal (1782–84; 3/41), Rot an der Rot (1785–1793; 3/36; the best preserved of his instruments),

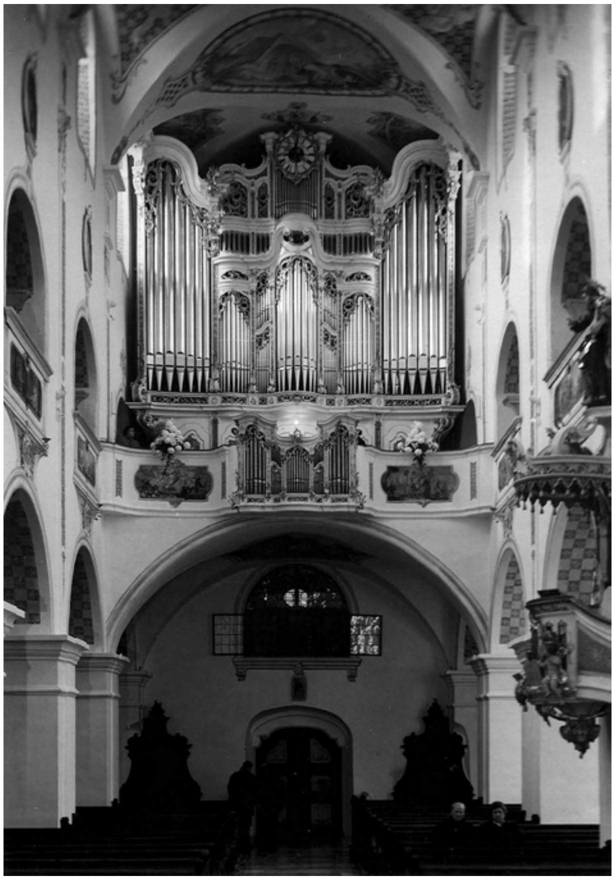

Fig. 49. J. N. Holzhay organ, 1776 (2/26), St. Johannes, Ursberg.

and Neresheim (1798; 3/47). The Ursberg organ was the last to use a RÜCKPOSITIV; instead, in addition to the Principal chorus of the Hauptwerk, he usually included a light Principal chorus in an OBERWERK that included a variety of foundations of other tone colors. A third manual or Echopositiv played pipes placed in the lower case of the organ, behind doors that could be opened or closed (Obermarchtal, Rot an der Rot); this resembled a type of BRUSTWERK, but differed from its North German counterpart, which would have been crowned with a Cornet. Because of their positioning by the large windows at the west end of churches, most of Holzhay's organs are in divided cases on either side of the large window. The Pedal divisions show strong French influence. The shift from the late Baroque to classicism was completed with Holzhay; even his cases reflect this transition, with the earlier cases being more Baroque, the later cases having more classical lines.

Alois Michael Holzhay (1784–1805), son of Johann Nepomuk Holzhay, apparently worked with his father but died in Maribor before establishing an independent workshop. Franz Joseph Holzhay (b. Oberegg, 11 Oct 1764; d. Reschen [now Resia], 6 July 1823) was a nephew of Johann Nepomuk Holzhay who worked as an organbuilder and joiner. His son Johann Kaspar Holzhay (1801–1867) also worked as a joiner; his brother, Johann Georg Holzhay (1805–1835), worked with Josef Pröbstl until 1831.

Johann Nepomuk's surviving sons would probably have pursued the organ-building trade; but the secularization (1803) and consequent dissolving of many abbeys and monasteries in Germany, together with the aftermath of the Napoleonic wars, had a disastrous effect on organ building in Upper Swabia. Even Johann Nepomuk's business survived this difficult time for only six years, while he turned to building cabinets.

DOUGLAS E. BUSH

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HOOFDWERK

SEE GREAT; HAUPTWERK

HOOK (AND HOOK; HOOK AND HASTINGS)

American organ-building firm, founded in 1827 by Elias Hook (1805–1881) and George Greenleaf Hook (1807–1880), sons of a Salem, Massachusetts, cabinetmaker. Elias served an apprenticeship with William M. GOODRICH, as did George, apparently. After building several small- and medium-sized organs in Salem, the brothers moved to Boston in 1832; in 1833 they built their first three-manual organ, for the First Baptist Church, Providence, Rhode Island. By the end of the decade they had built large organs for as far away as Philadelphia and Louisville, Kentucky. In 1845 they built their first concert hall organ (Boston, Tremont Temple), regarded by many organists as the first in the city capable of playing contemporary European music. The original Tremont Temple was destroyed by fire; in 1852, the Hooks built a more advanced instrument of four manuals as a successor; by this time, they were noted for the quality of their actions and reed stops.

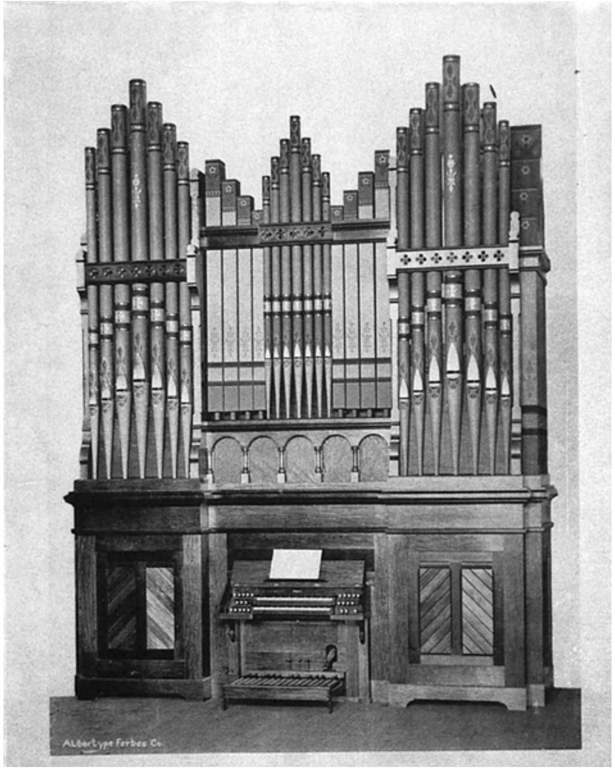

Fig. 50. Hook & Hastings organ (factory photograph, 1867 catalog).

Two years later the firm moved to a large new factory on the outskirts of Boston, near Roxbury Crossing; here the Hook firm built some of its most notable organs, including Boston, Immaculate Conception (1863); Worcester, Massachusetts, Mechanics Hall (1864), and Brooklyn, New York, Plymouth Church (1866).

Francis H. (Frank) Hastings (1836–1916) came to the Hook factory as a nineteen-year-old apprentice, but quickly worked his way up to the drafting department and in 1865 became a partner in the firm, taking charge of the design of some organs. Hastings led the firm in a new direction, strongly influenced by Romantic trends in France and Germany. While the firm's smaller organs remained reasonably conservative, some larger instruments (Woburn, Massachusetts, Unitarian Church, 1870; New York, St. Alphonsus, 1871) represented a rather bold foray into the Romantic aesthetic.

The name of the firm was changed to Hook and Hastings in 1871, and at around the same time the first catalog of "stock organs" was introduced. While the tonal and visual designs of these organs evolved over the years to reflect changing tastes, they were still being offered as late as the 1920s. Many models were sold over a period of more than a half-century; those remaining show them to have been carefully designed and well made. During the 1870s Hastings had charge of the building of several large instruments, including those for Boston, Holy Cross Cathedral (1875) and Cincinnati Music Hall (1878). The firm continued to build smaller instruments as well (op. 647, 1872; 2/16; rest. Redman, 1977; now at Galveston, Texas, Reedy Chapel AME Church; for illustration, see Roy A. Redman). After the deaths of the Hook brothers (who never officially retired), Hastings took full charge of the company, which completed its thousandth organ in 1880.

During the 1880s production was even greater than in the previous decade, with seventy-one organs being built in 1883; between 1888 and 1890, a large new factory was built in Weston, Massachusetts, on property owned by Hastings's family. Tonally the organs of this period tended to be more stringy and less bold than in the previous period, perhaps due to the hiring of a former E. F. Walcker man, Moritz Baumgartner, as head voicer. The three-manual organ at Roxbury, Massachusetts, First Church (1883) is a good example of this tonal style. In 1893 the firm was reorganized as Hook-Hastings Co., with Hastings's son, F. W. Hastings, and brother-in-law Arthur L. Coburn among the incorporators. In 1896 Hook-Hastings obtained a patent for an electro-pneumatic action, and used it in several large organs built shortly afterward.

Although its two-thousandth organ left the factory in 1903, Hook-Hastings faced significant competition at the turn of the century from builders trained in its own works, including George S. Hutchings, the Woodberry brothers, James Cole, and Harry Hall. After Hastings's death, the firm's work, while still of high quality, was increasingly overshadowed by younger builders such as Ernest M. Skinner. By this time, most Hook-Hastings instruments had electro-pneumatic action, and self-playing organs appeared among their offerings, followed in the 1920s by theater organs. Church organs of all sizes remained the mainstay of Hook-Hastings, however, and included large instruments for Boston, First Church of Christ, Scientist (1906), Rochester, New York, Lake Avenue Baptist (1917), and New York, Riverside Church (1927). Around 1930 Alfred R. Pratt became president of the firm, which was showing serious signs of decline. Only thirteen organs were built in 1930, and the number decreased steadily until the firm was liquidated in the summer of 1936. The firm produced 2,614 organs over its lifespan. Significant extant examples are found at Boston, Jesuit Urban Center (Church of the Immaculate Conception; 1863), and Boston, Cathedral of the Holy Cross (1875).

Jim Bishop

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HOPE-JONES, ROBERT (1851–1914)

English organ designer and inventor, active in the United States. Hope-Jones, born in Hooten-Grange, Cheshire, on 19 February 1851, was trained as an electrical engineer and worked in the telephone industry. His interest in the organ prevailed, however, and he began to apply his technical knowledge to the refining of the application of electricity to organs (Birkenhead, St. John's, 1886–89; electrified 1846 organ; added mobile console). He lectured on his theories in Great Britain, and by 1892 had set up the Hope-Jones Electric Organ Company to build and renovate organs, either in Battersea or at the factory of NORMAN AND BEARD (Norwich). He built about forty organs in England (London, Hanover Square, 1896), mostly straightforward, but with some use of borrowing and extension.

In 1903, Hope-Jones emigrated to the United States, where he associated with the AUSTIN Organ Company (1903) and the Ernest M. SKINNER Company, started his own Hope-Jones Organ Company in Elmira, New York (Ocean Grove, NJ, Auditorium, 1908; 4/13), and, after experiencing bankruptcy, associated with the WURLITZER Company. In every case, his obsession with creating and adjusting stop timbres made it impossible for his partners to conduct business in a timely manner, and he was pushed out. Selling his patents to Wurlitzer, he committed suicide in September 1914.

The American firms that worked with Hope-Jones adapted his ideas successfully to their respective styles in ways he was unable to implement fully, although dispute remains as to whether his "failures" were exaggerated. He had widespread influence through his electric and mechanical inventions, particularly as it related to the development of the modern electric ACTION. Among his many inventions or improvements were the use of silver wire contacts, more efficient magnets, individual SWELL shutter motors, the crescendo pedal, stop tablets instead of DRAWSTOPS, tilted keyboards for easier playing, the horseshoe CONSOLE design, the completely detached console, DOUBLE TOUCH, "Pizzicato Touch," and high-pressure pipe VOICING. The culmination of this work was the Wurlitzer Hope-Jones Unit Orchestra (1911), based on the concept of UNIFICATION, the availability of a given voice at several pitches and ultimately on all manuals (even pedals), an idea he had first mentioned in an 1891 lecture.

Perhaps less known is his fascination with organ stops. Besides patenting the DIAPHONE (1894), he pursued the creation of a truly orchestral organ, with imitative sonorities, dynamic and timbral contrasts, and enrichment of tone through the addition of partials. He developed other stops, including percussion, and freely used NICKING and EARS to achieve tonal goals. In addition, he developed the unit orchestra (later known as the UNIT ORGAN), by which pipes of stops with similar or otherwise related timbres were placed in their own chest, much as an orchestra had its sections.

Hope-Jones was an extremely charismatic figure, followed by many of his British employees when he emigrated, and was able to win over investors; his business practices were at best unrealistic. But he was a radical, temperamental, unwavering idealist who lived for the cause of improving the art of organ building. Such radical advancements were considered a mixed blessing—particularly, the subject of unification. In his own time, there was no middle ground; organ professionals were either very supportive or outspokenly opposed to him. To the conservative organ authorities of his time, his tonal and mechanical innovations seemed utterly sacrilegious; indeed, the Hope-Jones organ challenged many assumptions that, in theory at least, had always defined the proper pipe organ. Others were open-minded and curious to hear or try his radically different instruments; his principles and technology behind them soon became essential components of the THEATER ORGAN. To this day, the bipolarity of opinion about Hope-Jones remains, if at a less voluble level.

MICHAEL L. OHMAN
RICHARD KASSEL

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HORN DIAPASON

A variety of Diapason with a hornlike tone that results from the pipes being slotted. It dates from the late nineteenth century. The tone of the Horn Diapason is rather maligned in the literature: it "fails to satisfy the sensitive musical ear," is "objectionable on account of its hybrid nasality," and "rapidly becomes wearisome." Perhaps not surprisingly, the Horn Diapason found a home in the theater organ; concert organist Walter Strony gives it a most favorable review, calling it an "excellent binder" for other stops.

See also **Keraulophone; Stop**

Edward L. Stauff

HOUSE, GARRETT (1810–1900)

American organbuilder. Born in Johnstown, New York, on 9 August 1810, House supposedly served an apprenticeship, but the details of his early life are still unknown. In 1845, he settled in Buffalo, New York, where he worked until just before his death. At his peak in the early 1860s, he was building about seven instruments annually; in total, he built about 175 organs, mostly for clients in New York State, but a few were installed in the Midwest (South Bend, IN, University of Notre Dame, Sacred Heart Chapel, 1864; 2/31). House died in Buffalo on 21 July 1900, two years after he sold his firm to Charles B. Viner and Son.

Stephen L. Pinel

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HOUSE ORGAN

Any organ that fits into a domestic (or similar) setting; other names are box organ, cabinet organ, choir organ, continuo organ, home organ, practice organ, residence organ, trunk organ, and CHAMBER ORGAN. The plethora of terms is not only ambiguous, but somewhat inaccurate; many small churches have instruments that would serve equally well as a domestic organ. There is no other definition or limitation involved, except economics and regard for one's family or neighbors. One can, in fact, turn an entire house into an organ case—as in, for example, the Dupont family's Longwood Gardens, Kennett Square, Pennsylvania, instrument, with over ten thousand pipes.

While an instrument can be made to fit virtually any room, the term *house organ* suggests a degree of permanence, even if it is portable enough to be moved if needed. Portability made the medieval PORTATIVE ideal for ritual use; as a primarily monophonic instrument for doubling or self-accompaniment, it did not survive the evolution of Western music. Made larger and placed on a table, the POSITIVE, on the other hand, was a natural for service as a domestic instrument, and would lead to independent developments in the church RÜCKPOSITIV, including the SLIDER that made the breakdown of the BLOCKWERK into individual stops possible.

An unusual, possibly emblematic representation, by fifteenth-century engraver Israel van Meckenem the Younger (for a reproduction, see MEDIEVAL AND RENAISSANCE ORGAN), shows a domestic scene of an organist playing, with two hands, a single-manual, more or less chromatic positive resting on a table, while his wife, comfortably seated on the other end of the table, operates the two hand-bellows at the back of the instrument. There are four leverlike objects on the side facing the viewer, possibly decorative, but perhaps some form of slider controls, suggesting multiple ranks or stops.

Whether serving as an instrument for smaller court chapels, a practice instrument for professional organists, or an instrument for amateurs, the house organ has provided opportunities for builders (and their patrons) to experiment with new sonorities and mechanisms. On the one hand, there are relatively simple one- or two-stops, one-manual instruments, without pedals; this kind of instrument may come in the form of kits or instruments designed and built by their players. On the other hand, builders of more elaborate instruments have had to miniaturize increasingly complex technologies into house organs that work and sound well. While the case decoration may echo some finer details of larger instruments, those who can afford a house organ are usually encouraged to spend their money on an instrument that can evoke the sonority of a church instrument within the confines of a domestic space, rather than its facade.

The tone quality of the pipework and precision of the ACTION of a house organ must compensate for the lack of natural reverberation and absorption to be judged successful. VOICING pipes is especially delicate; the slightest mismatch of a single rank or poor juxtaposition of pipes can produce very apparent out-of-tuneness or ugly tonal blends. To include lower registers that would normally require pipes too large for the average room, the builder uses devices such as the STOPPED PIPE, the QUINT (a difference tone created by sounding two higher-register pipes), and the HASKELL BASS to meet this goal.

At first, small organs used a spring-chest with pin action, in which the depressed key moved a sticker down to open the pallet, allowing air to enter the upper chest from the lower, air-collecting chest and from there to the rank of pipes. Lower-register stops were played on the manual. Most house organs had one manual, occasionally two; there might be only one stop or more, depending on expense and space. As house organs grew in size, they also took on features of larger organs, such as the ROLLERBOARD that made transmission of tracker action possible. The evolving PEDALBOARD, first as a set of PULL-DOWNS, then as a separate division, became a part of the house organ. Further changes came with pneumatic actions, reed organs, and electric applications.

While house organs continue to be made by "traditional" builders, the invention of tube-based electronics shifted the focus of innovation to smaller instruments. The ELECTRONIC ORGAN arrived with instruments such as the Hammond organ (1930s), affordable organs with a variety of "old" and "new" sounds (including the Leslie speaker), popularized by increasing use in jazz and popular music. The postwar analog synthesizer was miniaturized when the switch from tube to transistor occurred; similarly, the electronic organ became smaller and more sophisticated with the introduction of solid state electronics. Most recently, the combining of sound production and computer led eventually to MIDI (musical instrument digital interface) and sampling technologies in the latter twentieth century. It is in this arena that experimentation on the house organ continues; parallel "authenticity" aesthetics have made organ building a form of radical conservatism, although MIDI and solid-state electronics have found their way into the large-scale and domestic pipe organ.

While the vast majority of surviving records of builders and their instruments focus on larger instruments for cathedrals, churches, and chapels, a 1665 contract agreement between builder John Loosemore and a member of the English nobility—for an organ with eight stops, including various flutes, trumpet, and a tremulant ("shaking stop")—must stand for many more domestic instruments. (The organ survives, as well.) Among the many builders and families responsible for house organs are, Richard Bridge, DALLAM, ENGLAND, Samuel GREEN, Renatus HARRIS, HILDEBRANDT, NIEHOFF, OBERLINGER, Wilhelm SAUER, Bernard SMITH, Arp SCHNITGER, SILBERMANN, John SNETZLER, Joachim WAGNER, E. F. WALCKER, and North American firms such as CASAVANT FRÈRES. While "catalog" instruments have been made and sold since the mid-nineteenth century, some firms will build customized instruments for their clients.

See also **Purchasing an Organ**

RICHARD KASSEL

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HRADETZKY

Austrian organ-building family. Gregor Hradetzky (1909–1984) operated the firm established by his grandfather (also named Gregor) in Krems (Lower Austria) in 1912, bringing the workshop to international renown during the 1950s and 1960s. His son, Gerhard Gregor Hradetzky (b. 1944) first trained with his father Gregor, then worked for Rudolf von BECKERATH in Hamburg (1962–65). He received the master diploma in 1972, then set up his own firm in Oberbergern, near Krems, in 1974.

Gerhard Gregor Hradetzky has specialized in building organs of modest size based on historical principles, using mechanical action, slider-chests, and, occasionally, early tuning systems. An instrument built for the Vienna Konzerthaus, Mozartsaal (1965; 2/25) is now located in Korneuburg, Lower Austria. Other Austrian organs include Vienna, Hochschule für Musik und darstellenden Kunst, Ursulinenkirche (1968; 2/28); Vienna, Conservatory (1976; 3/20); and instruments in Alsergrund, Burgenland, Carinthia, Döbling, Leopoldstadt, and Tirol. His installations in the United States include the St. Louis Priory (1966; 2/26); Palo Alto, California, Stanford University (1967; 2/24; later moved to East Coast); University of California–Los Angeles (1968; 2/21); University of California–Irvine (1971; 2/21); Red Bank, New Jersey, United Methodist (1975; 2/37); Los Angeles, Chapel of Immanuel Presbyterian (1977; 2/19); Riverside, Connecticut, St. Paul's Episcopal (1979; 2/35); Cleveland, St. Paul's Episcopal (1985; 2/22; North Italian style); Cleveland Museum of Arts (1991, positive; modeled on a 1680 Styrian instrument); and Gates Mills, Ohio, St.-Christopher's-by-the-River (1998; 2/18). The firm also has also built instruments for the University of St. Andrews, Scotland, and the Royal Northern College of Music, Manchester, and restored a number of older Austrian instruments, utilizing authentic techniques.

ARTHUR LAWRENCE

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HUNGARY

By the early sixteenth century, most Hungarian city churches and more important monastic churches possessed an organ. The most important Hungarian organ workshop in that period located in Budaszentlorinc (Pauline Order); others were in Pécs (Dominicans) and Esztergom (Miklós Széchényi). In addition to such local workshops, organbuilders from Austria, Italy, and also Poland worked in Hungary. Early sources give very little specific information about the instruments. A 1517 letter from Pécs mentions "newly invented stops" (*cum novis vocibus nunc inventis*) in the organ at Zagreb Cathedral (Croatia and Hungary were part of a dynastic union at this time).

The defeat of Hungary at the Battle of Mohács in 1526 led to the takeover of the central portion of the kingdom by the Ottoman Empire in 1541. During the approximately 150-year Turkish rule, Christian culture was preserved only in upper and western Hungary as well as the principality of Siebenbürgen, where the German-speaking majority (with its strong cultural ties to Saxony and Silesia) produced the largest number of organbuilders. The upper Hungarian cities of Kremnica and Banská comprised the most important organ-building centers of the sixteenth and seventeenth centuries. In cities along the western border region (Közeg, Sopron, Bratislava, Trnava/Nagyszombat) there were several local organbuilders, but many instruments of the late sixteenth- and seventeenth centuries were still built by German and Austrian masters. Accordingly, the oldest surviving organ in Hungary, located in Ödenburg, St. György (1633), is likely the work of the Viennese builder Johann Wöckerl.

Due to the growth of the Calvinist and the Unitarian churches in Siebenbürgen, organ-building developments slowed. Until the mid-eighteenth century, the organ was only played in churches of the Saxon Lutheran and Hungarian Székelyek Catholic denominations. Of the latter, the only known organbuilder was the Franciscan father János Kájoni (1629/30–1687) from Csíksomlyó. Saxon organ building was renewed by the work of Johannes Vest, an organ builder from Beszterczebànya (Neusohl) who settled in Hermannstadt (now Sibiu, Romania) in 1671 (Stadtpfarrkirche, 1672; case incorp. Sauer organ, 1914–15; rest. C. Scheffler, 1972).

Once the central portion of Hungary was free of the Turks at the end of the seventeenth century, new settlements began to appear regularly. Over the course of the eighteenth century, several more cities established themselves as centers of organ-building activity (Arad, Eger, Nagyváad, Pest, Temesvár). Most of the new workshops were founded by German-speaking craftsmen; some, such as Caspar Burchart (d. 1758) in Gyor, and Johann Jakob Jetter (1743–1788) in Güns, began organ-building dynasties that lasted over several generations. Most organs of this period were small instruments, of between four to eight stops, with one short-octave keyboard and no pedal. Even the larger organs generally did not possess more than fifteen to twenty stops, spread over two manuals and pedal. For this reason, the second manual was frequently rather weak, in comparison to the full Principal chorus of the Hauptwerk; the pedal was used almost solely for harmonic bass support rather than for contrapuntal lines. Characteristic manual stops found in these organs were those of the Holzgedeckt family (8', 4'); mutations or aliquot stops were represented by mixtures having two breaks per octave; such Quint stops as 2-2/3' and 1-1/3' were unknown. While reed stops were sometimes included in seventeenth-century Hungarian organs, they were all but forgotten in the next. Up until the second half of the nineteenth century, small organs continued to be built along Baroque lines.

From the beginning of the nineteenth century, larger instruments with from thirty to fifty stops began to appear, with a large number of narrow-scaled and conical foundation stops, a Cornet, and once again an occasional reed stop. Three-manual organs, however, were few. The most important organ builders of this period were Ferdinánd Komornyik (Pest, ca. 1820–1873), Franz Focht (Pécs, 1779–1852), Caspar Fischer (Abthausen/Apatin, 1772–1828), István Kováts the Elder (1797–1843) and Younger (1828–1881; both in Szeged), and István Kiszel (Debrecen, 1820–1880). The Salzburg builder Ludwig Mooser (1807–1881) settled in Erlau in 1863 and built two of that era's largest organs in Hungary, at Gran Cathedral (1856) and Erlau Cathedral (1864). Those instruments, together with a number of smaller organs, mark him as the most productive organ builder in Hungary in the mid-nineteenth century.

Organ building around Siebenbürgen began its renaissance in the second half of the nineteenth century. Its leading builder was István Kolonics (Kolonits) in Kézdivásárhely. József Angster (1834–1918), who had studied and worked with Aristide CAVAILLÉ-COLL in Paris during his journeyman years, opened his workshop in Pécs in 1867. His first instrument, built in the French style, still stands unaltered in the Pécs Synagogue (1867–69). His later instruments also bear the marks of French influences (slider-chests and BARKER LEVERS up to 1900, a large Swell division), although he gradually adopted more of the central European organ styles. His firm was the most productive in Hungarian organ-building history, building more than thirteen hundred instruments within a span of eighty years. In addition to Angster, other important Hungarian builders of the late nineteenth century were Sándor Országh (Budapest; Keszthely, Synagogue, 1898), Antal Dangl (Arad, 1810–1892; Obad, Catholic Church, 1886), and Lipót Wegenstein (Temeschwar, 1858–1937). Angster's most important competitor, however, was the Budapest affiliate of RIEGER Orgelbau in Jägerndorf, Austria (now Krnov, Czech Republic).

The development of Hungarian organ building from the late nineteenth century up to World War II parallels that of Germany. At the turn of the century, cone-chests were replaced by various pneumatic actions. After World War I, large areas of Hungarian territory were divided up among neighboring states; Hungarian firms lost a large part of their market, and many important workshops folded. During the 1920s the cooperative efforts of the Angster firm and József Geyer (1887–1953), an organ historian of international stature, produced several instruments not unlike those of the Alsatian reform movement (Budapest, Dominican Church, 3/33). In the 1930s the influence of the German ORGAN REFORM MOVEMENT were manifest in the use of quasi-Baroque specifications. Miklós Váradi (1883-1962), a foreman of Országh, founded a Budapest firm in 1920, building mechanical and pneumatic action instruments.

After World War II, the Communist regime discouraged any further development, and eventually nationalized all firms. Some, such as the Angster firm, were eventually dissolved (1951). Others (e.g., Váradi) survived by doing repairs and some rebuilding; new instruments with either pneumatic or electro-pneumatic actions were of modest quality. Váradi continues under István Váradi (1958); its works include organs at Kalocsa and Pécs Cathedrals. The turning point occurred in 1970, when the first noteworthy tracker action revival organ was built in the Budapest district of Deák tér (Protestant church); this initiated a trend of improvement in both tonal conception and quality. The driving force behind this process has been the AQUINCUM ORGANBUILDER COMPANY, directed by Gábor Kovács, which took over the Rieger Budapest workshop in 1974 as a nationalized firm (following the ouster of the Rieger firm); it began building tracker organs two years later. Aquincum was denationalized and became a privately held company in 1990–91.

PÁL ENYEDI

Translated by Douglas E. Bush

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HURDY-GURDY

A misnomer for the street barrel organ, a form of MECHANICAL ORGAN that originated in Italy and gradually made its way to England. The real hurdy-gurdy is a keyed fiddle that uses a crank-operated wheel to play its melody and drone strings. Despite the similarities (playing mechanism, use of drones), the hurdy-gurdy is in no way an automaton, while the street organ is a small hand-cranked automaton par excellence.

RICHARD KASSEL

HUSS, BERENDT (D. 1676)

German organbuilder. While a renowned organbuilder in his own right, Huss is chiefly remembered as the teacher and cousin of Arp SCHNITGER, one of the most important organbuilders of all time. Huss probably came from Oldenburg, where his family name was common, or from the region around it. His career began as master apprentice to Hermann Kröger, during which time he worked on the facade of the Stadtkirche organ in Celle (1653). After Kröger's death Huss was named privileged builder to the court of Celle. Schnitger entered Huss's workshop in 1666; he later completed his teacher's instrument work at Stade, St. Wilhadi (1673–76) after Huss's death.

Apart from working on the organs in Mariendrebber (1658–59), Zetel (1662–65), Meldorf Cathedral (1663), Geversdorf (1664), Wilster (1666), Varel (1667), Oldenburg, St. Lamberti (1664–70) and the Stadtkirche in Glückstadt (1674–75), Huss built new organs in Diepholz (1655–56), Eckwarden (1658–60), Glückstadt (1661–65), and Stade, St. Cosmae (1668–73).

DAVID SMIT

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HUTCHINGS

Series of American organ-building firms led by George Sherburn Hutchings. Born in Salem, Massachusetts, on 9 December 1835, Hutchings was trained as a carpenter before joining Hook and Hook as a casebuilder (1857), soon becoming its foreman. After service in the Union Army (1861–63), he returned to Hook and was appointed factory superintendent. In 1869, Hutchings, Mark Plaisted, and G. V. Nordstrom left Hook and joined with organist and consultant John Henry Willcox (1827–75), who had worked with William B. D. Simmons between 1858 and 1860, to form J. H. Wilcox and Co (Waltham, Massachusetts, Piety Corner Chapel, 1/8, extant; Boston, Peace Jubilee Coliseum, 1872, 2/29, uncased, lost). In 1872, the firm became Hutchings, Plaisted and Company; its instruments included Boston, E. Thayer Studio (1875; 2/16, hydraulic motor; moved to Woodstock, Vermont, North Chapel Universalist, 1881); Lowell, Massachusetts, First Universalist (1875); Newburyport, Massachusetts, Immaculate Conception (1875; 2/20, mech.; reb. Lahaise and Sons, 1980); Boston, New Old South Church (ca. 1876; 3/55, Hutchings, Plaisted's largest); Worcester, Massachusetts, All Saints (1876; 3/46; repl. Skinner, 1924); Nashua, New Hampshire, Church of Good Shepherd (Episcopal) (1881; 2/15; repl. Aeolian-Skinner, 1949); and Bellows Falls, Vermont, United Church (1883; 2/15, mech.; rest. S. J. Russell, 1984). Plaisted left in 1884, and the firm became the George S. Hutchings Company of Boston.

Hutchings now moved toward a more Romantic, French-influenced style. He became Hook and Hastings's main competition in the Northeast. One of the company's early projects was the dismantling of the Boston Music Hall Walcker organ (1884), which became the centerpiece of the Methuen, Massachusetts, Music Hall many years later. Among Hutchings's surviving instruments of this period: Charlottetown, Prince Edward Island, St. Peter's Cathedral (1886; 3/43, electro-pneum.: reb. Casavant, 1947; A. Evers, 1972); Newburyport, Massachusetts, First Religious Society (Unitarian) (reb. 1834 Alley organ, 1889; 2/24, mech./electric; reb. Andover, 1957); Wrentham, Massachusetts, Trinity (Episcopal) (reb. 1825 Goodrich/1860 Simmons and Wilcox organ, 1890; 2/18; reb. Hutchings, 1912; reb. Andover, 1966); Boston, Mechanics' Fair (1892; 2/19, probably his first pneum. organ); Gloucester Massachusetts, Independent Christian (1895; 2/23; reb. Fisk 1962); Boston, Arlington Street Church (1895; 3/49; electro-pneum., his first); New Britain, Connecticut, South Congregational (1896; 4/64; Skinner electro-pneum.; detached console; enclosed choir, Great [partial]); Winnipeg, Manitoba, Christ Lutheran (1897; 2/17, mech.; reb. Stuart, 1979; orig. East Boston, All Souls Universalist); and Boston, Our Lady of Perpetual Help (Mission Church) (1897; 3/56, electro-pneum.; rest. Lahaise and Son, 1968). Also noteworthy is the nave organ at New York, St. Bartholomew's (Episcopal) (1896; 4/96, electro-pneum.), upon which Leopold Stokowski played while serving as church organist (1905–8). This instrument was incorporated into a Skinner (1918), then enlarged by Aeolian-Skinner in 1970–71 (5/168, electro-pneum.; last job compl.).

During this period, Murray M. Harris apprenticed with Hutchings (ca. 1889–94). Of greater significance was Ernest M. Skinner's employment there during the 1890s. Skinner installed several Hutchings organs and helped his employer develop an electro-pneumatic action (1895), which Skinner developed further when he left to form his own firm (1901). Hutchings, who had started using tubular-pneumatic action (Brooklyn, New York Avenue Methodist (1890; 3/60; voiced by Carlton C. Michell), created his own, less successful form of electro-pneumatic action (1902). Hutchings and Skinner also developed the "bat-wing" console, made possible by pneumatic action. Skinner's last job for Hutchings was at Binghamton, New York, First Presbyterian (1901; 3/50; ren. Guilbaut-Thérien, 1996).

In 1901, Hutchings went into partnership with Edwin S. Votey, formerly of Farrand and Votey, inventor of the Pianola and vice-president at Aeolian (1897–1901), and built a new factory in Boston. The firm built Aeolian residence player pipe organs as well as its own large pipe organs; survivors include: Philadelphia, First Presbyterian (reb. 1872 Simmons, 1901; 4/91; reb. Reuter, 1998–2000); Providence, Rhode Island, Brown University, Sayles Hall (1902; 3/60; rest. Potter-Rathbun, 1990; largest extant concert hall Hutchings); New Haven, Connecticut, Yale University, Woolsey Hall (1902; orig. 4/55; reb. Skinner, 1928; now 4/143); Detroit, St. John's (1904; 4/51; reb. Casavant, 1964–65); and Providence, First Church of Christ, Scientist (1907; 3/39; rest. Thompson-Allen). In 1903, the American Guild of Organists adopted its first design standard: Hutchings's version of the Willis concave/radiating pedalboard. In Seattle's St. James Cathedral, a combination of a 1907 Hutchings-Votey (4/53; rest. Marceau and Associates, 1996) and a 1999 Rosales (4/36) has produced the most successful and recorded organ pairing in the United States.

In 1908, four years after its Boston factory burned down, Hutchings-Votey declared bankruptcy, and Votey left the firm. Hutchings reorganized as the Hutchings Organ Co. (Waltham, Massachusetts) and built organs until his death: Williamstown, Massachusetts, Williams College, Thompson Chapel (1910; three manuals; reb. Andover, ca. 1960) and San Francisco, Old First Presbyterian (1910–12; 3/64, rest. and reb. Visscher, 1994). He died in Cambridge, Massachusetts, on 1 June 1913.

Over time, Hutchings's instruments shifted from a New England tracker mentality to the late nineteenth-century vanguard (French influence, electro-pneumatics, English reed stops), and the firm became among the most important in the U.S. But the fine quality of the organs was not matched by any change in tonal philosophy, and Skinner and others were already heading in new directions in the new century. Hutchings built more than six hundred instruments, of which more than one hundred survive. With the neobaroque movement no longer a cause celèbre, American restorers such as ANDOVER and GEORGE BOZEMAN Jr. have begun to bring his Romantic instruments back to life.

RICHARD KASSEL

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HYDRAULIS

The earliest documented organ, an instrument of classical antiquity whose wind was stabilized by water pressure. The invention of the hydraulis was attributed to CTESIBIUS (Ktesibios), an Alexandrian engineer of the third century BCE who became famous for using air pressure to operate mechanical devices. Ctesibius created the hydraulis when he connected a set of pipes to a source of wind via a key mechanism. Although the original description of the apparatus, recorded in his *Commentaries*, has been lost, accounts by VITRUVIUS (*De architectura*) and Hero of Alexandria (*Pneumatics*) provides information about the instrument.

The term *hydraulis* derives from the mechanism that harnesses water pressure to produce the wind that enters the pipes. A pump handle operates a plunger that forces air from within a cylinder into a conduit leading to a funnel-shaped air container. This container, or *pigneus*, is open at both top and bottom and is placed neck upward on blocks in a water cistern. The pressure of the incoming air displaces some of the water in the cistern, and as the plunger is depressed to prepare for the next stroke, the weight of the water pushes the air into the windchest of the organ. The pipes stand above the windchest; they receive air through a system of perforated sliders, controlled by keys that are depressed by the organist.

There are about forty surviving representations of the hydraulis, and although these are often damaged and difficult to date, they reveal several salient features of the instrument. The total height from the base to the top of the pipes was about 165–185 cm. The base, which was often octagonal, supported the water cistern, usually flanked by a pair of cylindrical pumps. A rectangular windchest, of comparable size to the base of the organ, was placed on top of the cistern. The height of the pipes on this chest represented from one-third to one-half of the instrument's total height. No more than four ranks of pipes are depicted, with from about four to eighteen pipes per rank. The hydraulis was played by a standing organist, who moved the sliders by depressing keys with his fingers.

Pipe fragments from Pompeii (now in the Museo Nazionale, Naples) seem to belong to two different instruments; although the pipes were cast, they were not originally part of a Roman organ. Surviving parts of a hydraulis in the Aquincum Museum, Budapest, provide more evidence. The dedicatory plaque is dated 228; there are four rows of thirteen cast bronze pipes, one open and three stopped with oak stoppers. Little can be deduced about the timbre of the pipes, although there is no indication of reeds. Slotted metal sliders admit wind to the channel for each row of pipes, and wooden keys operate the sliders corresponding to each note. No trace of the winding system is extant.

Modern reconstructions of the Aquincum organ by Perrot and Walcker-Meyer present very different interpretations of the archaeological remains; Perrot believes that the pipes formed a chromatic scale, while Walcker-Meyer maintains that the tuning was diatonic. Unfortunately, pictorial and theoretical sources are even more inconclusive about the tuning and pitch of the hydraulis.

The only evidence for the hydraulis in Europe after the fall of Rome are references to the organ built by GEORGIUS, and illustrations in manuscripts such as the Utrecht Psalter (ca. 830) and the Eadwin Psalter (twelfth century), which depict hydraulic organs with two water cisterns. This winding system does not appear to have been implemented in practice, however. The earliest European treatises on organ building, by THEOPHILUS and the Anonymous of Berne (eleventh century), document bellows organs with slider mechanisms similar to those used in the hydraulis.

See also **Classical organ (Greek and Roman antiquity)**

KIMBERLY MARSHALL

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I

ICONOGRAPHY

The interpretation and analysis of musical subjects depicted in works of art. The plastic arts often represent aspects of contemporary life, and they may therefore contain important information about musical instruments and performance practice during historical periods from which few written records and instruments survive. This is especially true for the early history of keyboard instruments, whose presence in such varied media as paintings, illuminations, sculptures, and stained glass documents a rich tradition before 1500. In addition, musical scenes in art can supplement the knowledge gained from surviving historical instruments by providing clues about the performance techniques, contexts, and ensembles relating to the organ and other keyboard instruments.

The first stage in any iconographical study is to locate and catalog as large an artistic sampling as possible from which to make musical deductions. Kinsky's *History of Music in Pictures* (1930) paved the way for subsequent publications, such as the *Musikgeschichte in Bildern* series (1961–89) and Bowles's *Pratique musicale du moyen-âge*, which made musical subjects in art more accessible to musicologists. The need for a more comprehensive and collaborative approach to musical iconography was addressed by the creation of the Répertoire International d'Iconographie Musicale (RIdIM), established in 1971. Since that time, RIdIM has endeavored to locate relevant iconographical material and to create photographic archives in national and regional offices throughout the world.

In order to make use of these sources in musical research, it is necessary to determine what sort of information may be conveyed in pictures. Leichentritt's pioneering article of 1905–06 asks this very question, which has been answered by Brown and Lascelle in their manual of cataloging musical subjects in art, the system adopted by RIdIM. Studies relating to a specific instrument, artistic medium, or historical period may require a more specialized system for assessing organological information, such as that developed by Marshall for late-medieval illuminations of the organ.

A fundamental problem encountered in any iconographical study is the accuracy, from a musicological perspective, of the work(s) of art studied. When assessing artistic sources, therefore, it is vital to take into account the effects of artistic license and the copying of other pictorial models. Yet objectivity may also be undermined by a modern perspective that considers photographic art, where objects are modeled in light and shade to appear three-dimensional, to be more "realistic" than schematic drawings that appear two-dimensional. As Ripin has shown, even a depiction as detailed and apparently "accurate" as the Ghent Altarpiece (1432) contains inconsistencies that invalidate its use as a blueprint for the construction of an organ. To serve as organological evidence, artistic representations of instruments must be drawn with correct proportions and detail; the artist's concern for a three-dimensional realism does not always increase the amount of musical information contained in a depiction.

The recent proliferation of iconographical catalogs has made it possible to locate depictions of keyboard instruments that have remained unknown for centuries. Perrot includes reproductions of early depictions of the organ, and Foster's study of thirteenth-century French manuscripts offers many references to miniatures showing the organ. Illuminations depicting organs and stringed keyboard instruments may be found using iconographical files or catalogs for specific collections such as the Bodleian Library or the Bibliothèque Royale in Brussels (Hottois's catalog). Especially significant for keyboard studies are Bowles's "Checklist[s] of Musical Instruments," which document some of the earliest representations of the organ and stringed keyboard instruments.

The increasing importance of iconography to musicology is evidenced by the founding of *Imago Musicae*, a journal that features musical scholarship based on pictorial sources. Also noteworthy are the profuse illustrations in *Early Music*, where iconography provides important evidence for performance practice. These accomplishments are bringing musicians and scholars into closer contact with pictorial sources that depict keyboard instruments and some of the contexts in which they were performed.

KIMBERLY MARSHALL

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IMPOST

In the main organ CASE, the architectural horizontal "section" above the CONSOLE that stretches across the entire case and supports the CHESTS and everything else above it; it may project slightly as it forms the case's initial horizontal plane, visualizing from the console upward. (Where there is a true RÜCKPOSITIV or CHAIR ORGAN, the view of the impost from the audience may be obscured, literally.) WINDCHESTS are often located just behind the impost, which may be designed plainly or share some of the filigree and sculptural tone of the case itself.

INSTRUMENTS, COLLECTIONS

The organ might seem an unlikely candidate for inclusion in a public museum. Any church with a carefully preserved and maintained instrument is a living museum at least once a week; municipally or privately held organs are available for performance at any time. However, smaller instruments of the past have become proud property of museums throughout the world, whether for their intrinsic musical, iconographical, or design importance.

In some museums, organs are but a tiny percentage of the collection. In the National Music Museum in Vermillion, South Dakota (formerly the Shrine to Music Museum), there are over ten thousand instruments, of which three are small organs (northern German, J. J. Hanss, ca. 1620; St. Gall, Gemeind Cappel, J. Looser, 1786; Orwigsburg, PA, Zion Lutheran and Reformed, Dieffenbach family, 1808, enl., 1884; now 1/9) and one Reuter theater organ (2/37/ped, pneum.; first installed at the Lyric Theater, New Ulm, MN. 1927–28).

At the other extreme, Europe has several museums dedicated exclusively to the organ, especially of the hand-operated (barrel, street, hurdy-gurdy) or automatic (band/fairground) variety. The United Kingdom is especially fond of such collections, among them the Victoria and Albert Museum in London. Germany is home to the largest number of pipe organ museums, whether church-centered (Kelheim, Bavaria, former Franciscan church), privately sponsored (Weimar, Thuringian Organ Museum–Gottlob Töpfer), dedicated to one historical builder (Frauenstein, Saxony, Gottfried Silbermann Museum), or maintained by an active builder (Windesheim, Rheinland-Westphalia, Orgel ART Museum, Gebr. Oberlinger).

Richard Kassel

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INTERNATIONAL SOCIETY OF ORGANBUILDERS

See Organizations

IRELAND

Up to 1660, the history of organ building in Ireland is largely conjectural; thereafter, documentation becomes reasonably reliable, but not without frustrating gaps in sources. The oldest surviving organ case is that of Cambridge builder Lancelot Pease for his Trinity College, Dublin, organ (1684), now in the gallery of the college's Examination Hall. The chapter acts of St. Patrick's Cathedral, Dublin, reveal that in 1695 Renatus Harris was commissioned "to make and set up a double organ." In 1697, Bernard Smith, having failed to deliver an organ he was contracted to build for Dublin's Christ Church Cathedral, lost the contract to his rival, Harris, who fulfilled his commission by sending across the rejected instrument he had made for London's Temple Church. On arrival it was assembled by the Dublin builder John-Baptiste Cuvillie. Little of

Harris's two Dublin cathedral organs have survived. Possibly the best surviving example of Harris's work in Ireland is the nonauthenticated 1713 instrument in St. Mary's, Mary Street. Parish records refer to the "organ maker" without name, yet arrangement of pipe towers, flats, and lips, point to Harris as the probable builder.

Samuel GREEN's widow Sarah built the 1797 organ for the chapel of Trinity College (case survives), while Green's contemporary, John SNETZLER, built the organ for St. Stephen's, Mount Street, Dublin; St. Peter's, Drogheda; and the parish church in Hillsborough, County Down. The best Dublin-based builder of the eighteenth century was the Saxon native Ferdinand Weber, who settled in Dublin in 1739 and built notable instruments for two Dublin churches, St. Catherine's and St. Werburgh's; the case and some pipework of the latter survive in situ. John BYFIELD I appeared in Dublin in 1728 to take over the care of the two cathedral organs, persuading Christ Church officials to purchase an entirely new organ (ca. 1750). The Hollister dynasty, originally from Cork, moved to Dublin to establish a thriving building practice in the eighteenth century. There was also Robert Woffington (d. 1819), probably a pupil of Weber, who built a much-admired organ for St. Andrew's, Dublin.

The early nineteenth century saw the emergence of two influential Dublin-based organbuilders, John White and William Telford. White flourished as a builder from 1845 to around 1860, while his two sons continued manufacturing organs until around 1912. White drew heavily on Aristide CAVAILLÉ-COLL in the design and manufacture of his instruments, and got his reeds from the latter's supply house. A number of his instruments survive in varying degrees of intactness, most notably the three-manual 1858 instrument now in Our Lady of Refuge, Rathmines, Dublin; the 1888 instrument in the Redemptorist Church in Limerick; and the organs of Dublin's Gardner Street Jesuit Church and St. Andrew's, Westland Row.

The Telford family moved from Warwickshire to Dublin in 1825; in 1830, twenty-one-year-old William Telford set up his organ and piano workshop in premises adjoining the family home. He probably trained with one of Dublin's local organbuilders, such as Hull or Lawless, but his rise to eminence was swift. By 1840 he was firmly established, supplying organs for the rapidly expanding post-Emancipation market of Roman Catholic churches and convents, as well as house organs for the Anglo-Irish gentry. By 1847 he had built over one hundred instruments and had taken his brother, Henry, into partnership with him, trading from then until 1870 as Telford and Telford. Telford's earliest extant organ is the 1838 one-manual instrument for Killala Cathedral, County Mayo. Also surviving are the organ now in St. George's, Carrick-on-Shannon, County Leitrim (1847; 2/13) and the twin three-manual instruments of 1858 (with neogothic cases by W. A. Pugin) for the twin neogothic churches in Wexford Town. Instruments built for export included those for Radley College, Abingdon (1847) and St. Paul's, Dunedin, New Zealand (1864). Other indigenous nineteenth-century builders were Joseph Brown of Dublin and Seymour Murphy of Cork.

Throughout the nineteenth century prominent English builders continued to gain significant contracts in Ireland. Thus we have J. W. WALKER organs in Rathkeale, County Limerick (1845), a three-manual of GG compass in Bandon, County Cork (ca. 1860), and a magnificent three-manual in St. Audoen's, High Street, Dublin (1861). There are several Conachers of the 1870s and 1880s; one of the best examples still exists in St. Mary's, Cork, with a French-style reversed console with terraced stop jambs; the original pneumatic action still functions. In Cork's Christ Church (now the city's Archive Centre) there is an 1878 T. C. LEWIS. Gray and its successor GRAY AND DAVISON built several instruments in Ireland, as also did Bevington, including his splendid three-manual for St. Alphonsus, Ballybrack, County Dublin (1860). HILL AND SON built significant organs for Ulster Hall, Belfast (1862) and the cathedrals of Cork (St. Fin Barre's, 1870), Belfast (1875) and the Pro-Cathedral, Dublin (1890). Henry WILLIS is represented by what was to be his last large-scaled instrument, for St. Patrick's Cathedral, Dundalk (1900), while his influence may be found in Henry Willis II's splendid 1902 instrument for St. Patrick's Cathedral, Dublin.

The early part of the twentieth century saw little organ-building activity of significance, and it was not until the 1970s that the instruments of Kenneth Jones of Bray, County Wicklow, brought a renaissance to the craft, and something of the German ORGAN REFORM MOVEMENT to Ireland. Jones's arrival had been aesthetically presaged by the 1963 J. W. Walker redesigning of the three-manual Gray and Davison of St. Bartholomew's, Clyde Road, Dublin, into a two-manual tracker instrument with lightened wind pressure and redesigned mixtures. Jones's new instruments, beginning with his two-manual tracker organ for Ballina Cathedral (1974) and followed by instruments for Christ Church Cathedral, Dublin (1984) and the National Concert Hall in Dublin (1991), are major landmarks in contemporary organ design that have placed Irish organ building at the heart of European achievement in the craft. The Austrian RIEGER organ (1974) in St. Michael's, Dun Laoghaire, County Dublin, is one of the country's best-known recital instruments. Work by Trevor

Crowe at Adam and Eve's Church, Dublin, and his virtually new three-manual for St. Bartholomew's, Clyde Road, Dublin (2002; see above), and the Wells-Kennedy Partnership's significant work in Northern Ireland (notably the new 2001 instrument in Christ Church, Londonderry) all point to the new aesthetic in organ building having firmly taken root in twenty-first-century Ireland.

GERARD GILLEN

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ISNARD, JEAN-ESPRIT (1707–1781)

French organbuilder, active in southern France. Born in Bédarrides, Vaucluse (chris. 22 Jan 1707), Isnard's background and training are unknown. He became a Dominican lay-brother. The earliest mention of him is in 1734, when he worked on the organ at La Major, Arles. Among his organs are those of St. Pierre, Avignon; St. Trophime, Arles; and the cathedrals of Aix-en-Provence, Nimes, and Albi. François BÉDOS DE CELLES knew him, and discusses his work in his treatise. Isnard died in Tarascon (buried 16 Mar 1781).

Isnard's masterpiece is in the Basilica of St. Maximin-en-Var (1773; 4/43), the work of Isnard and his nephew and pupil Joseph Isnard (1740–1828), who would later settle in Bordeaux and repair organs damaged during the French Revolution. This organ has survived intact and is regarded as an outstanding example of eighteenth-century French organ building. Among Isnard's other pupils were another nephew, Jean-Baptiste Isnard (1726–1800; Pithiviers, SS Salomon et Grègoire, 1784; reb. Cavaillé-Coll, 1890; rest. Boisseau, 1965; now electro-pneum.), who worked with Joseph in Orléans, and Joseph Cavaillé, great-uncle of Aristide CAVAILLÉ-COLL.

WILLIAM HAYS

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ISRAEL AND PALESTINE

Although the history of organs in Palestine and—later—Israel goes back to the eighteenth century, the organ music culture of this region is not fully recognized. In modern times—one assumes the existence of an organlike instrument called *magrepha* or *ugav* in antiquity—the first known instrument was installed in 1766 in a Franciscan church in Jerusalem. In the mid-nineteenth century an organbuilder belonging to the Franciscan order settled in the Old City (Jerusalem). He started a small factory that still exists today and is supervised by the Spanish monk Fernando Taboada.

The initial impulse for organ building in Palestine came from Germany. At the end of the nineteenth century, Emperor Wilhelm II sponsored three new instruments. For the inauguration of the Evangelical Lutheran Church of the Redeemer in the Old City in 1898, he donated an organ built by the Heinrich Dinse firm, Berlin. In addition, Wilhelm II sponsored organs for the Immanuel Church in Jaffa (1904) and the Church of the Ascension on the Mount of Olives, built by Wilhelm SAUER (1910; 2/24).

Other instruments in this early period were built, including one for the Christian Information Center in the Old City by AGATI (1847; 1/9); two by Austria's Mader firm, one in the Ecco-Homo-Church in the Old City (1893), the other in the Institute of St. Peter of Sion in Jerusalem (1898; 2/10). The MAURACHER firm exported an instrument to the John the Baptist in Ein Karem (1893) and to the Basilica St. Stephan in Jerusalem (1900). Most of these instruments were small electro-pneumatic instruments with a typical Romantic disposition.

An historically important organ that set new standards for organ instruments in this region was finished in 1932 by the American AUSTIN firm for the International YMCA in Jerusalem. Financially supported by the Juilliard Foundation, the instrument consists of four manuals and forty-seven speaking stops, including a 32' Contra Bourdon in the pedal, and was for a long period the largest pipe organ in the Middle East. With stops as the Celesta and the set of Chimes, the Austin organ is a typical instrument for the concert hall of the 1930s, with some features recalling THEATER ORGANS or ORCHESTRIONS. After two decades of languishing, it was dismantled in 1999.

After the state of Israel was founded in 1948, the number of organs increased. Well-known organbuilders, such as MARCUSSEN AND SON, SCHUKE, Paul OTT, OBERLINGER, RIEGER, and E. F. WALCKER, as well as the Israeli builder Gideon Shamir, started building new instruments. The majority have two manuals and pedal and an average number of twenty stops. Unusual are two wind organs built by Shamir for the sculptor Dani Karawan. The first was installed in 1948 in Beer Sheva and is part of a monument for fallen soldiers designed by Karawan; the second is located in a tower in Tel Aviv, close to the seashore.

In October 2002, the Rubin Academy of Music, Tel Aviv, installed a new instrument, by the EULE firm of Dresden (3/39). While most of the significant developments in organ construction have taken place in Jerusalem or the Tel Aviv area, there are instruments in Haifa, Bethlehem, Nazareth, and some smaller towns. Today, we know of more than thirty instruments, most of them in Jerusalem and in Tel Aviv. In Israel, places where an organ may be installed are private houses, churches, and public halls. Because of the significant influence of orthodox Jews in Israel, there is no organ in any synagogue; Islam has a similar ban on instruments in its places of worship.

TINA FRÜHAUF

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ITALY

The beginnings of organ building in Italy are rather obscure. Masters Zucchetto and Jacobello restored the organs in St. Mark's, Venice, between 1316 and 1364. During the fifteenth century, some northern European masters built instruments in northern Italy. At the beginning of the fifteenth century, Italian organ specifications were similar to those of organs built in France or Spain. These early organs normally had one keyboard and no pedal. The pipes on the WINDCHEST were not at first divided into stops, but very soon a stop called Tenori (Principale, PRINCIPAL) was differentiated from the whole (Padua, 1440; Cremona, 1440). Before the end of the century, the ranks of the Principale chorus were separated into stops, indicated solely by the interval above the fundamental (Tenori, Ottava, Quintadecima, Decimanona, Vigesimaseconda, Vigesimasesta—that is, Fundamental, Eighth, Fifteenth, Nineteenth, Twenty-Second, Twenty-Sixth), so that a variety of sound colors could be selected; a Flauto stop also appeared (Padua, 1493). By the middle of the fifteenth century, the Italian organbuilders had begun to distinguish their work from the already developed organ traditions in northern Europe. The first distinction made was between the Principale and a new rank called the RIPIENO (a "pyramid" of Principale ranks). It differed from the medieval MIXTURE in that the voicing of the high and low ranks of pipes was better balanced. According to surviving contracts, the ripieno was to have a compact and clear sound, speaking as if it were a single stop. The late fifteenth and turn of the sixteenth centuries marks what was probably the most splendid period of Italian organ building (ANTEGNATI, LUCA BLASI, Giovanni Battista FACHETTI, Lorenzo da PRATO, Onofrio Zeffirini), but organ dimensions as well as stoplists remained almost unchanged.

Every Italian organ built from the early sixteenth to the mid-nineteenth centuries was based on a ripieno, even as pipe scales varied over the centuries. The Principale rank varied, according to the organ's size, from 2' to 24', and consequently the number of ripieno ranks from two or three to nine or ten. Most of the foundation pipes (i.e., the Principale rank) were located in the facade, sections of which served a purely aesthetic function (*organetti morti*, "little dead organs," made up of DISPLAY PIPES). Antonio Barcotto (*Regola, e breve raccordo*, 1652) divided the instruments into classes: *organi grossi da muro* (large instruments built into the church wall, or SWALLOW'S NEST), *organi grossi* (large-sized instruments erected on the floor), *positivi* (POSITIVES of the cabinet type), *ad ala* (wing-shaped), *portatili* (PORTATIVES), *regali* (regals), and *claviorgani* (CLAVIORGANS).

Musicians and organbuilders judged the beauty of an organ not by the variety of the sound colors it could create, as in other European countries, but by the extremely fine quality of the sound given by single stops as well as the whole ripieno. The first MUTATION stops appeared by the middle of the fifteenth century in the form of a single 4' Flute stop, a simple disposition popular for well over a century. A typical Italian stop, the undulating Voce Humana (VOX HUMANA), was added to the ripieno in the sixteenth century, and other Flute ranks were gradually inserted into the stoplist, such as the "Flauto in XII" (TWELFTH) and "Flauto in XV" (FIFTEENTH). These new stops were used to play the *canzoni*, even during church services, together with the Principale. A more powerful stop, the Cornetto, was introduced as a "Flauto in XV" (SEVENTEENTH). A Trumpet or Trombone stop also appeared in the standard Italian organ stoplist when the PEDAL was added. For a long time, this type of pedal operated the keys of the corresponding notes of the lowest keyboard octave (generally a short octave), depressing the manual keys by PULL-DOWNS made of strips of leather.

Beginning in the seventeenth century, one of the first MECHANICAL AIDS was applied to Italian organs large and small; it allowed the organist to choose one free combination (the *tiratutti*), putting on some or all the stops. From that time, a wide-scaled wooden flute or Bordone (a FOUNDATION STOP tuned one octave lower than the keyboard Principale) could be brought on gradually with an octave stop to avoid a sudden fortissimo. This limited type of pedal was in use in Italy until the middle of the nineteenth century, but most small organs continued to be built without pedals (as they had been built in the Renaissance) until the first half of the twentieth century. They were usually played in rural churches. Bigger instruments had a richer disposition from the middle of the seventeenth century on, when foreign organbuilders (Vincenzo FULGENZI, C. Zimmermann) introduced a wider variety of flue and reeds stops: new conical flutes, the SESQUIALTERA, a first (high) and second (lower) Cornetto, Trumpets, and Tromboncini; the REGAL, which used several of these stops, remained a separate instrument until the middle of the seventeenth century. Organs with two manuals were not as rare as in previous centuries, but the foundation of each organ chest remained the ripieno. The eighteenth and early nineteenth centuries saw such important Italian builders as CALLIDO, TRONCI, and Bossi (VEGEZZI-BOSSI).

It was not until the nineteenth century that bigger organs became the norm in major Italian churches. These large factory organs, with two manuals of up to seventy-two keys each (like those of the Viennese pianoforte), and a little wider compass in the pedal (but no more than seventeen to nineteen keys), were made in Lombardy (northwestern Italy). Among a few organ-building families, the SERASSI firm was the most important. Their organs at most featured thirty or forty stops, the richest organ dispositions in Italy—apart from a few exceptional instruments (Catania, Pisa)—and thus were diametrically opposed from the ideals of contemporary European organbuilders.

From the first half of the nineteenth century on, two manuals operated a GREAT (*organo grande*) and a POSITIV (*organo piccolo*, a positive located on the left side of the main organ case). The chests' stoplists were designed so that the positive acted as an echo organ. The foundation of both the chests continued to be the ripieno; the larger the church, the wider the compass. The stoplist of the *grand'organo*, the ripieno of which went up to the XL stop (Fortieth), was much richer than that of the positive, which was limited to the XXIX stop (Twenty-ninth). The Principale rank was doubled in most organs, and a device was inserted to couple each key of the treble with the octave higher, the *terza mano* (third hand). The number of mutation stops increased; many were treble-bass DIVIDED STOPS, operated by separate stop levers, encouraging solo effects on a single manual.

In the nineteenth century, the specifications for the main organ covered every kind of stop—both flues and reeds—geared to imitations of orchestral families, mostly the instruments of the then-popular wind *bandas* (Clarinet, Oboe, English Horn, Cromorne, Trumpet, Trombone, Clarion, Bassoon, Bombard, Serpent). New flue stops were introduced, modeled on various kinds of flutes (Flageolet, Corno di Notte, Corno Dolce, Corno da Caccia, Ottavino), as well as strings such as Violin, Viol, and Violoncello, which gave the organ a new stridency. The Pedal division had only a few independent stops (Tromba, Trombone, Bombarda) in addition to the older Contrabasso, a flute-like stop coupled with an octave rank; but when in communication with the keys of the bass octave, the Pedal produced more powerful tones, replacing the brighter ones of the earlier Italian foundation stops. The Pedal could also be coupled mechanically with one or both keyboards, usually by wire trackers (leather strips were still used in small-sized organs), to overcome the modesty of the pedal chest. (The Italian repertoire of that time did not require a pedal compass larger than seventeen to twenty keys.) Some pedals operated percussion stops such as Tamburo (drum), Piatti (cymbals), and Campanelli (bells). The case of the positive was enclosed in a swell box, and a pedal operated the movable shutter for dynamic changes. A new type of *tiratutti* ("alla lombarda," in the Lombard style) was applied to all large-sized organs.

A new trend arose around the middle of the nineteenth century: the Saint Cecilian movement, a Roman Catholic revivalism of German origin but largely centered in northern Italy. The beginning of the revival of Johann Sebastian Bach's organ music was also highly influential on Italian organists and builders. Cultural exchanges and the immigration of a few foreign organbuilders (including the Englishman G. W. Trice) introduced European designs as well as new technologies that the Italians incorporated into their instruments without abandoning the Principale concept. Most medium-sized organs, with two keyboards (each more than fifty keys) and a pedal of thirty-seven keys, continued to have modest stoplists, usually fewer in number than the Lombardian organ. A number of new types of 8' and 4' stops (Salicionale, Aeoline, Voce Celeste, Unda Maris) were dominant in the Italian Cecilian organ. The soft Voce Celeste and an undulating Viol Choir took the place of the Cornetto and the Tromboncino. The highest ranks of the ripieno were abandoned, and the remainder consolidated into low and high Mixtures. The Physharmonica stop was sometimes inserted into the positives. The Principale pipes were now voiced more smoothly by means of ears, beard, or rollers, thus losing the historical richness in partials typical of the Italian Principale tone.

Toward the end of the nineteenth century, technology previously unknown in Italy was incorporated into all new instruments; pneumatic ACTIONS became all-pervasive from the beginning of the twentieth century. During this period, many older organs were modernized, and a large number of masterpieces of the past were thus lost. Instruments were no longer enclosed in cases, and pipes were arranged like theatrical curtains on either side of the organist. Smaller organs, particularly in southern Italy, continued to be built with the traditional Italian mechanical operating system until the 1940s. In the 1970s, an organ revival took place, and old Italian mechanisms such as the *catenacciatura* (ROLLERBOARD) and *meccanica sospesa* (suspended action) were reintroduced into most of the newest instruments, even the biggest ones. Electric and electronic devices were often used in the new mechanical organs, but only for operating sliders, rather than key action.

There are thousands of surviving Italian historical organs. Many of the positives were abandoned for a long time, even those that were not in bad condition; these remain substantially (and fortuitously) unmodified. A number of new organs, in the organ revival or hybrid Cecilian style, have been built since 1950. Restorations of important old instruments—notably, those altered during the nineteenth century—have been undertaken, as well as of a number of positives.

MARCO TIELLA

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J

JACKSON, JAMES (?1785–1858)

American organbuilder of English origin. Jackson, probably born in Manchester, immigrated about 1825 and opened a shop in New York. A May 1840 notice stated that he was vacating his shop; from that time until his death, he is believed to have worked for Henry Erben. Jackson built organs in the typical English style. At least two are extant; the better preserved is an 1834 organ located at St. John's Episcopal, Ellicottville, New York. He died in New York City on 21 December 1858. His son, Samuel P. Jackson (1818–1885), worked with him (Jackson and Son), and later became well-known as a teacher, organist, and composer.

Stephen L. Pinel

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JAECKEL, DANIEL J. (B. 1946)

American organbuilder. Born in Milwaukee, Wisconsin, on 30 October 1946, Jaeckel pursued advanced training in numerous subjects, and received a B.A. from Concordia College in River Forest, Illinois. He established Jaeckel, Inc. in Duluth, Minnesota in November 1978, after associations with RIEGER, Lawrence I. PHELPS, and SCHLICKER Organ Company.

Dedicated to mechanical action instruments, Jaeckel's early instruments reflected a contemporary Germanic approach in design, stoplist, and voicing. His 1986 organ built for Wausau, Wisconsin, Salem Lutheran (thirty-eight stops) was built strictly along late-seventeenth-century North German lines in consultation with Harold Vogel. Two French instruments followed, the first for Duluth, Pilgrim Congregational (1988; 3/49); the second, for Sudie George Chapel, First Presbyterian Church of Dallas (1988), was patterned after choir organs of Aristide CAVAILLÉ-COLL. During the 1990s, Jaeckel researched

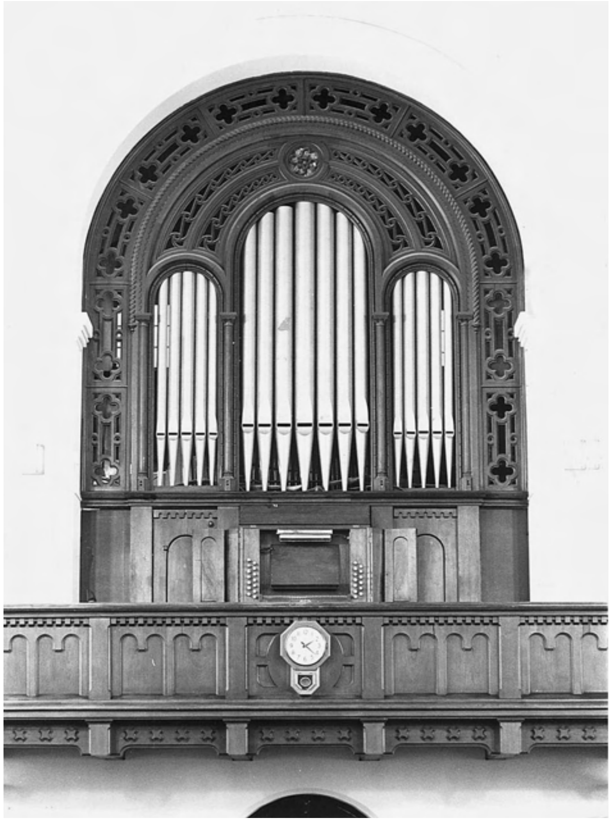

Fig. 51. Jaeckel organ, St. Joseph's Church, Duluth, Minnesota.

additional national styles and incorporated both south German and English influences in several organs, with French and Germanic influences figuring significantly in many instruments. His opus list now numbers over 50 instruments.

Jaeckel has consistently traveled throughout Europe and North America seeking knowledge and inspiration from historical and contemporary builders. He has no single specialty, but is at ease with a diversity of national styles and historical periods which equip him and his shop to build organs either within sharply defined parameters or with a valid eclectic specification and action.

JESSE E. ESCHBACH

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JAHNN, HANS HENNY (1894–1959)

German scholar, author, philosopher, and organbuilder. Jahnn was a prolific poet, award-winning dramatist and novelist, and authority on organ building. He was born in Stellingen near Hamburg, 17 December 1894. His association with the organ began as early as 1913, and by 1916 (in Norway) he was intensely involved in organ studies. He was an outspoken critic of late-nineteenth-century organ building (although he accepted Aristide CAVAILLÉ-COLL's work with reservations), and he determined that the foundations of German organ building had disappeared and needed to be reestablished. In 1919 he and his friend, Gottlieb Harms, happened into Hamburg's Jacobi-Kirche and became acquainted with the Arp SCHNITGER organ in such bad state that the church had decided to remove and replace it. Jahnn began researching the instrument and convinced the authorities to let him restore the organ, a task he completed in 1923. This was the first major restoration of an historic organ and became a symbol and a model for the *Orgelbewegung* (ORGAN REFORM MOVEMENT).

Jahnn's work with the Schnitger organ had prompted studies of the pipework and led him to consider theories and perform experiments relative to what an organ should be. In 1925 in Hamburg, together with Günther Ramin (future cantor at St. Thomas, Leipzig), he initiated the first congress of the *Orgelbewegung* (Orgeltagung Hamburg-Lübeck). The conference concerned itself with North German Baroque organs. In 1927 he cofounded the German Council of Organists and directed some of its work between 1931 and 1933; he was also active as an organ consultant in Hamburg.

Between the years 1933 and 1945 Jahnn lived in political exile in Denmark and served as a consultant to the Theodor FROBENIUS firm in Copenhagen. Altogether, he consulted or designed the restoration or construction of over one hundred organs; several of the new organs incorporated Jahnn's ideas, such as the segregation of what he termed "masculine" and "feminine" stops. Examples of this include the KEMPER organ at Hamburg, Heinrich-Hertz-Schule (now Lichtwarkschule), Hamburg (1931) and the HAMMER organ at Langenhorn/Hamburg, Angarskirche (1931). In 1921, Jahnn cofounded Ugrino, a utopian religious community; in 1923 Ugrino established its own publishing house, devoted to the publication of early music. Jahnn became its owner in 1956. He died in Hamburg on 29 November 1959.

DOUGLAS E. BUSH

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JANN

German family of organbuilders. Georg Jann (b. 1934), who fled East Germany in 1961, eventually settled in Regensburg, where he took over a small organ-building workshop in 1974; his first organ followed in 1975 (Schlicht, Katholische Pfarrkirche, 2/18). Jann built increasingly larger instruments; the commissioning of an organ for Memmingen, St. Josef (1980; 4/52; reb. J. Maier, 2000), led to the relocation of Orgelbau Georg Jann to a larger workshop in Allkofen-Laberweinting, Lower Bavaria. The firm established its international reputation by building significant instruments for, among others, Waldsassen Basilica (choir, 1983, 3/33; main, 1989, 3/60); Oporto, Portugal, Cathedral (1985; 3/45); Rangendingen, St. Gallus (1988; 3/42); Pfeffenhausen, Katholische Pfarrkirche (1988; 3/31); Yokohama, Kanto Gakuin Womens College (1989; 3/33); Weiden, Stadtpfarrkirche Herz Jesu (1990; 3/51); Villach (Austria), Katholische Stadtpfarrkirche (1992; 3/40); Tokyo, Othsuma University (1993; 3/41): Bamberg, Konzerthalle "Sinfonie an der Regnitz" (1993; 4/74); Munich, Liebfrauendom (choir, 1993, 3/36; main, 1994, 4/95); Helmstadt, St. Martin (1994; 3/36); and Oporto, Nossa Senhora da Lapa (1995; 4/64).

Jann served as an organ consultant and completed a small number of restorations in Europe (Anger, Styria [Austria], Pfarrkirche, anon. 1708–11 organ, 1983, 2/22; Weltenburg, Benedictine Abbey, 1729 J. K. Brandenstein organ, 1/12, 1992–95, now 1/14). These experiences and his well-received earlier work in Portugal made him a logical choice for participation in a commission on the authenticity of a 1701 Arp SCHNITGER organ at the monastery in Moreira da Maia, near Oporto. The group decided in favor of the instrument's being a Schnitger, in part because of the lack of nicking on the pipes. Having remained in Oporto to build the new instrument at Nossa Senhora da Lapa, Jann decided to remain in Portugal, turning over the firm to his son Thomas Jann; he had by this time built over two hundred instruments. Another son, Detlef Jann, has become active in organ electronics and has worked with both father and brother on different projects.

Thomas Jann, who trained with Richard Rensch, has continued the firm, now under his own name, building instruments in locations such as Regensburg, St. Anton (1996; 3/39); Nienburg, St. Martin (1997; 3/38); Michelstadt, Ev. Stadtkirche (1999, 3/42); Biberach, Dreifaltigkeitskirche (1999; 3/26); Gotteszell, St. Anna (1999; 3/45, French symphonic); and Altötting, Stiftspfarrkirche (2000; choir, 2/29; main, 3/49). His restoration of the 1912 Stahlhuth organ at Dudelange (Luxembourg), St.-Martin (2001–02; 4/74) has been exceptionally well received.

Georg Jann remained in Portugal and created Orguin Pipe Makers in Avidos, Braga in 1995. The now moderately sized firm makes a full range of German-type pipes and bellows at a lower cost than would be possible elsewhere in Europe, thanks to the lower wage levels in Portugal as compared to Germany. Jann himself continues his interest in Schnitger, having restored the instrument at Coimbra, Santa Casa da Misericórdia (2001).

RICHARD KASSEL

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JARDINE

American organ-building firm. George Jardine, born in Dartmoor, Kent, on 1 November 1800, apprenticed and worked for Flight and Robson of London, specialists in the manufacture of barrel organs, until that firm's demise in 1835. After a brief period with Joseph WALKER in the same city, he emigrated with his family to New York and set up his own shop there in 1837.

Initially, Jardine supplemented his building activities with a general music business; however, by the early 1840s he had established himself and, in spite of a somewhat depressed economic climate, was able to build a new factory. The company competed successfully with Henry ERBEN and later Hilborne L. ROOSEVELT for prominence in the New York trade. Jardine, like Erben, enjoyed a national reputation and clientele; only New England, with its strong native organ-building school, resisted significant encroachment by the two New York titans. Among Jardine's best-known New York instruments were Fifth Avenue Presbyterian (1855, 1875), St. George's Episcopal (1869), and the new St. Patrick's Cathedral (1873). A few of the firm's larger organs are extant, among them Sacred Heart, Brooklyn, New York (1877) and St. Patrick's, Watervliet, New York (1890).

Jardine's tonal designs reflect their period. Early organs generally have English-style ensembles, much like the instruments of his contemporaries. Post-1870 instruments show a pronounced turn, even in Great divisions, away from fully developed chorus ensembles, in favor of a variety of unrelated solo voices and varied unison colors. The change in philosophy is reflected in the nomenclature of such stops as Boehm Flute, Clarinet Flute, Saxophone, and Horn Diapason, and in the frequent inclusion in larger organs of a "chime of bells," a set of bars struck with mallets. Even within choruses, higher pitched stops and mixtures are attenuated in later organs, and unison stops are of a large scale relative to the upper work. While Jardine organs show excellent workmanship, materials vary. Whereas Erben used walnut for actions and mahogany for chest tops, even in his smallest instruments, only Jardine's large or more prestigious contracts utilized such woods.

Unlike Erben, Jardine experimented with mechanical innovations. The company's brochure of 1869 claims the introduction of such innovations as overhanging manuals, terraced stopjambs, and radiating pedalboards, and the first use of equal temperament in the United States. While there is certainly a bit of hyperbole in the assertions, Jardine was, in fact, among the first builders to introduce all the features cited.

George Jardine died in New York on 12 February 1882. Jardine and Sons remained a major New York builder until after 1896, the year Jardine's sons and successors, Edward and Joseph Jardine, both died. Thereafter its day-to-day operations passed out of family hands, and in 1899 it finally closed.

John K. Ogasapian

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JEAN DE JOYEUSE

See Joyeuse, Jean de

JENKINS, EDGAR H(ENRY) (1836–1924)

British-born New Zealand organbuilder. Born in Poole, Dorset, Jenkins was apprenticed to William Hill in London in 1850, and worked there until 1858, interrupted by military service during the Crimean War (1854–56). Jenkins moved to Europe and worked for Aristide Cavaillé-Coll from 1860 to 1862. During this time he was employed in Spain, working on a three-manual organ for the Basilica of Santa Maria del Coro in San Sebastian (1863) and an organ in Oyarzun. Jenkins then returned to London to work for Hill.

Jenkins emigrated to New Zealand in 1868 and built three instruments (1875, 1877, and 1879) before settling in Christchurch in 1880. There he installed the 1881 Hill and Son organ in the Anglican Cathedral. Opening a factory in 1882, he built three organs and part of a fourth before his bankruptcy in 1884. Jenkins supervised the building of a large organ for the 1885 Wellington Exhibition, but most of his work remained predominantly tuning and installing. In 1897 and 1903 he built two larger organs; a third begun in 1904 was interrupted by the renovation and moving of the 1881 Hill Christchurch Cathedral organ (1906). In partnership with a young English organbuilder, Herbert Brett, Jenkins relocated a large electric action organ from the 1906–07 New Zealand International Exhibition, Christchurch to a city theater. They also built a new organ in 1909, after which the partnership failed. Jenkins' last organ was completed in 1911, at the age of seventy-five.

Jenkins used mostly New Zealand woods, importing ivory keys and Oregon and Sydney cedar for wooden pipes. Metal pipes were imported from Hill in London and Fincham in Melbourne. His style of organ building was derivative of English organ building of the 1860s. The most complete Jenkins organ in original condition, for the Lyttelton Orphanage (now Lyttelton Union Church), with a detached reversed console after Cavaillé-Coll, is otherwise identical in style to his others.

Ronald G. Newton

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JEU DE TIERCE/CORNET

(It. *cornetto*; Sp. *corneta.*) French term for a complete complement of wide-scaled registers on a seventeenth- or eighteenth-century organ. The registration derives its name from the inclusion of the Tierce 1-3/5', the most distinctive element in the sonority. In instances where a given pitch is not represented by a Flute stop, a Principal may be substituted. Thus, a typical Jeu de Tierce on a French Positif of 1700 would include a Bourdon 8', Flute 4', Nasard 2-2/3', Doublette 2' (or Quarte de Nasard 2'), and Tierce 1-3/5'; if available, a Larigot 1-3/5' could be drawn as well. Tierce registrations on the Grand Orgue include the Petite Tierce du Grand Orgue (8.4.2-2/3.2.1-1/3) and the Grand Jeu de Tierce (16.8.3-1/5.4.2-2/3.2.1-3/5').

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JOHNSON

American organ-building family. William Allen Johnson (1816-1901), founder of the company, was born in Nassau, New York. His father, a millwright, moved to Massachusetts in 1819. Willian was apprenticed to a mason in 1834, and in 1838 began a construction business; his interest in organ building began in 1843, when he helped set up a new HOOK AND HOOK organ in the Methodist Church, Westfield, Massachusetts. He was apparently so fascinated with the organ that he built his first instrument, a "parlor" organ with one set of pipes and no pedals, during the winter of 1843–44. In 1847 he gave up his construction work to devote himself to organ building. Johnson's first organs were built in a house owned by his wife's parents in Westfield. The Johnson workshop, the W. A. Johnson Church Organ Manufactory, was located opposite that house; it was destroyed by fire in 1871. Organs were built in temporary quarters until a new Westfield workshop, Church Organs—Johnson and Son, was in use by 1873. Until the late 1860s, the organ nameplates read "Wm. A. Johnson–Westfield, Mass." and included the date. By 1869 the plates read "Johnson, Westfield, Mass." and included both the opus number and the date. Between that year and 1874, two other designations appeared: "Johnson and Co." and "Johnson Organ Co." After 1874, the name of the firm had permanently changed to Johnson and Son.

In 1871 Johnson's son William H. Johnson (1841-1922) became a partner; reorganization gradually occurred, as evidenced from the changing nameplates. William H. Johnson attended the public schools and Westfield Academy, studied organ, and began working in his father's shop as early as 1856. He eventually became an organist, draftsman, and voicer, and frequently played recitals on the new instruments. During the mid-1880s, a larger factory was built behind the Johnson family residence; during the last years of the company's existence, William H. Johnson assumed active management of the firm. About 1898 he decided to become a broker, the establishment closed, and the building was sold to a Johnson employee, Emmons Howard (who built the organ for the Pan-American Exposition in Buffalo, 1901). Other Johnson employees who established their own businesses were John W. STEERE, G. W. Turner, and J. E. Treat.

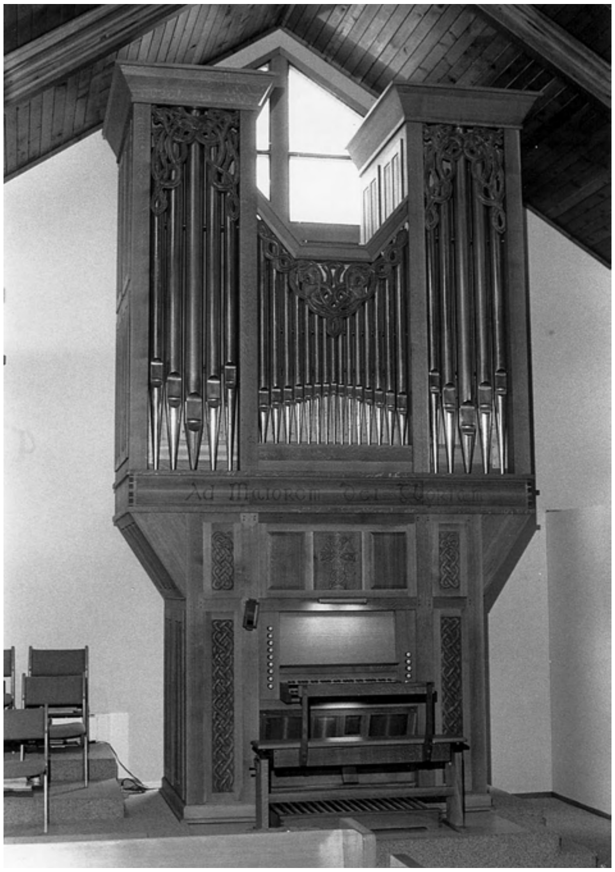

Fig. 52. Johnson organ, 1855 (2/19), Westminster Presbyterian Church, Syracuse, New York.

In 1894 Johnson and Son published a "list of organs"; an 1898 supplement included all instruments built after 1894. The earliest instruments were parlor organs. The first church organ was built for Chicopee, Massachusetts, Grace Church (1848; 1/6; lost). The first two-manual organ was for the Westfield First Congregational Church (1849; 2/20; lost). The three-manual instrument for Hartford, Connecticut, South Congregational Church, was the largest Johnson to date (1854; 3/42; lost). The largest organ built by the firm has not been ascertained, since the instruments' sizes were not completely documented after 1876. A substantial number of large three-manual organs were built after the early 1870s, including the instrument for the Second Presbyterian Church in Chicago (1873; 3/59), by far the largest Johnson organ up to that time.

A unique Johnson and Son contribution to U.S. organ building was the "patent reed." Invented by William A. Johnson and patented in 1877, this design featured a shallot with a reversed taper, and a reed tongue structured to conform to this shape. This configuration provided for the production of an unusually powerful and brilliant tone, unlike other American chorus reeds of the time, although similar in some respects to French reeds of the same period.

Johnson organs were installed in thirty states (fifty were built for Chicago alone) and the District of Columbia, Canada, and Bermuda, but the majority were located in New England. Out of the 860 organs produced by the various incarnations, there remain only about one hundred that are more or less tonally intact; of these, fewer than fifty are preserved in unaltered condition. The majority of the others were destroyed by fire, junked, or rebuilt beyond recognition. Only five three-manual instruments out of ninety-nine such organs on the lists survive in relatively intact states.

Among the surviving Johnson organs, the oldest known is now in the Heath, Massachusetts, Union Evangelical Church (1851; 2/17), but it is not completely intact. Originally built for the Haydenville, Massachusetts, Congregational Church, it was moved twice and now lacks its original case. The oldest unaltered Johnson is at the Montague, Massachusetts, First Congregational Church (1/7); the latest is a two-manual in the Manchester Center, Vermont, First Baptist Church (1896; moved there from the Union Church, Proctor, VT). The largest and finest surviving Johnson was built for Boston, St. Mary of the Sacred Heart (1877; 3/54; includes Johnson patent reeds). The church itself was a victim of "urban renewal," but the organ was moved to the Church of SS Peter and Paul, Convent of Our Lady of Good Counsel of the School Sisters of Notre Dame in Mankato, Minnesota. Despite the electrification of the key and stop action, there has been no revoicing, and the organ remains a fitting monument to its builders.

The Johnson firm was one of the most important nineteenth-century American organ-building enterprises. The significance of this highly respected firm, often sought out by the most distinguished clientele of the era, remains a matter of personal opinion, but it is generally agreed that the quality of materials, workmanship, and voicing in Johnson organs was of the highest possible caliber, whether in the most comprehensive three-manual instruments or the smallest one-manual organs. Furthermore, compared to the work of other American organbuilders, the Johnson sound is almost always recognizable. Although other American builders of the period presented distinctive and definable tonal, mechanical, and visual characteristics, the unique Johnson tonal ensemble is rarely mistaken for something else.

DONALD R. M. PATERSON

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JOHNSTON, THOMAS (1708–1767)

American organbuilder, musician, and engraver. Born in Boston, Johnston pursued a number of artistic trades, from ornamental painting and japanning to the engraving of maps and psalm books; he has the distinction of having been the first to engage seriously in the repairing and building of organs in New England. He was self-taught; the one remaining fragment of his work, the case of an organ he built in 1759 for Christ Church, Boston, indicates that he modeled his organs after those of Bridge and other English builders that were imported to Boston by the middle of the eighteenth century.

By 1741, Johnston owned a small organ that he lent to Trinity Church in Boston. Whether or not he was its maker is unclear; it was probably this same organ that Johnston lent to Christ Church, Boston, in 1752, and St. Paul's Church in Newburyport, Massachusetts, in 1753. His first known church organ was built in 1754 in St. Peter's, Salem, Massachusetts. A year earlier he was paid for setting up an organ in a church in Nansemond County, Virginia, but he may not have been the builder; he is recorded as having set up imported instruments, including the 1756 Richard Bridge organ in King's Chapel, Boston.

Only three other organs are positively attributable to Johnston: Boston, Deblois's Concert Hall (ca. 1754), Boston, Christ Church (1759), and Portsmouth, New Hampshire, St. John's (1760); but it is highly probable that he also built chamber organs; at his death an unfinished organ was listed among his possessions. Although Johnston's son Benjamin Johnson and son-in-law Daniel Rea, Jr., are said to have built organs, the two were probably only assistants to Thomas Johnston, for there is no proof that they engaged in such work after his death in Boston on 8 May 1767.

Barbara Owen

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JOYEUSES, JEAN DE (CA. 1638–1698)

French organbuilder of the seventeenth century. Joyeuses is associated particularly with the organ of St. Mary's Cathedral, Auch, typical of the Louis XIV period. His apprenticeship details are not known, but he was certainly influenced by Cliquot and Thierry, and Parisian organists and builders rapidly appreciated his qualities. Rather than simply maintaining organs, he was keen to build "Parisian" organs everywhere, with increased wind pressure, mixtures "of great effect," and "brilliant" reeds; it had become important that the organ fill the whole church, not just part of it.

Joyeuse, a native of Chemery-sur-Bar in Ardennes, was engaged in 1666 to check the modifications made to the organ at Paris, St. Jacques de la Boucherie. He began a series of restorations with Paris, St. Séverin (1669), Pontoise, St. Maclou (1672), Lyons, La Charité (1674), Rodez Cathedral (1676), and Toulouse, St. Sernin Basilica (1678). He reconstructed the Flemish-style organ of Béziers, St. Nazaire Cathedral (1680); this newly French-style organ was to serve as a model for his succeeding work.

Joyeuse moved to Carcassonne, where he was organist of St. Nazaire Cathedral (1680–84) and built a new organ for St. Michel. In 1688 he renovated the 1584 Spanish-style Joseph Bordons organ of St. John's Cathedral in Perpignan. His most impressive masterpiece is at Auch Cathedral, large for its time (1688; 4/40): his name now appeared in the Royal Construction Accounts, the king having declared this instrument "the finest of the kingdom." The case is unusually beautiful, and the remaining soundboards and pipework are of great quality. This organ remained intact until 1957, when a misguided "restoration" destroyed 60 percent of it. In 1997, however, a total restoration in the original aesthetic was completed by Jean-François Muno. Joyeuse then moved to Toulouse and may have built the small organ of St. Catherine's Convent at this time; his final contract was for St. Just's Cathedral, Narbonne, but he died in March 1698 before completing it.

Jean-Renaud Ansart
Christopher Hainsworth

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JUGET-SINCLAIR

Canadian organ-building firm. After working for Hellmuth Wolff, Goll Orgelbau, Johannes Rohlf, and Karl Wilhelm, Denis Juget (b. Annemasse, Haute-Savoie, France, 23 Apr 1961) started his own shop in 1994 with a contract to build a three-stop practice organ. Between 1994 and 1998 he built seven practice organs and a continuo organ, and restored two nineteenth-century organs. In 1998 the shop was moved from his backyard to a shop in Montreal, and he founded Juget-Sinclair, Facteurs d'Orgues with Stephen Sinclair (b. New York, 6 May 1965), who had worked for Wolff, Bernard Aubertin, and Mander. The firm builds smaller mechanical action instruments for churches, practice organs for universities and individuals, and continuo organs. They also do restorations of early Canadian tracker instruments.

When building a new organ, all elements are worked out in relation to the room where the organ will be installed and its intended purpose. The design work is done with computer, and traditional methods are then used to build the organ. With the exception of the electric blower, every organ is constructed entirely in-house. Juget-Sinclair organs are noted for an elegant simplicity of design, and voicing is carefully done so as to complement sensitive action and flexible winding.

Representative organs include Stoneham, Quebec, Waterhouse residence, 1993 (2/3); University of Cincinnati, practice organ, 1999 (2/10); Provo, Utah, Brigham Young University, 1999 (1/3); Hickory, North Carolina, Holy Trinity Lutheran, 2001 (2/15); Québec

City, Ensemble Anonymous, organetto, 2002; and Tokyo, Hatsudai Catholic Church, 2004 (2/15).

Douglas E. Bush

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Juget-Sinclair, Facteurs d-orgues, Organbuilders http://www.cam.org/~sinc/.

JUST INTONATION

In unaccompanied vocal music this term refers to the ideal of singing by which every consonant interval is untempered and therefore has a simple frequency ration—2:1 for the octave, 3:2 for the fifth, 4:3 for the fourth, 5:4 for the major third, 5:3 for the major sixth, 6:5 for the minor third, etc. In the 1550s Giovanni Battista Benedetti demonstrated (in a letter to Cipriano de Rore) that to realize such an ideal would entail changing the overall pitch level of the notes by a syntonic COMMA (about 1/9 of a whole tone) in practically every harmonic progression.

On traditional keyboard instruments, where such changes of the pitch level are unfeasible, just intonation means a kind of tuning when most of the fifths and thirds are untempered—at the expense of rendering several such intervals in each octave very sour, including at least one of the fifths among the diatonic notes (most likely D–A or G–D, rendered smaller than pure by a syntonic comma) and, ultimately, the WOLF FIFTH. No mainstream composer has written music for such a tuning, but the distinctive and beautiful sound of untempered consonances led, in the sixteenth and seventeenth centuries, to the invention of some interesting experimental harpsichords, most notably by Joan Albert Ban.

See also **Tuning and Temperament**

Mark Lindley

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K

KAMMERTON/CAMMERTON

See Pitch and Pitch Standards

KASCHENDÖRF, STEPHAN (CA. 1425–CA. 1499)

South German organbuilder, one of the first documented in that region; also called Kaschendorff. No records remain to identify with whom this native of Breslau (now Wroclaw, Poland) learned organ building. But by 1460 he was recognized for his work, and traveled extensively through the areas of Franconia, Saxony, Silesia, Swabia, and Thuringia. It is likely that he had some association with Ludwig von Breslau, an organbuilder active in the area of Nördlingen, Nürnberg, and Ulm between 1431 and 1464.

Though no specifications survive, it is known that Kaschendörf's instruments used independent divisions (Brustwerk, Hauptwerk, Rückpositiv) and stops, thus marking one of the early developments departing from the medieval traditions of the Blockwerk. He is known to have built organs for Breslau, St. Maria Magdalena (1455); Nürnberg, St. Egidien (1460); Breslau, St. Elisabeth (1460–64); Nördlingen, St. Georg (1464–66); Nürnberg, Frauenkirche (1464–66); Grossenhain, Saxony (1469); Erfurt Cathedral (1480–83); Augsburg, St. Ulrich und Afra (1490, chancel organ); and Schweidnitz, Silesia (now Swidnica, Poland; 1495–99). Kaschendörf died in Schweidnitz sometime after 4 February 1499.

Douglas E. Bush

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KASTENS, LAMBERT DANIEL (FL. 1710S–D. 1744)

German organbuilder, working in Denmark. Kastens was a pupil of the renowned master organbuilder Arp Schnitger in Neuenfelde near Hamburg and in time became one of his most trusted colleagues. After Schnitger's death in 1719 Kastens took over the former's license to build organs in Schleswig, Holstein, Oldenburg, and Delmenhorst. His workshop was in Itzehoe (Holstein), but in the 1720s he also set up business as an organbuilder in Copenhagen, and in 1728 he obtained a license to build organs in Denmark and Norway. Owing to the many important assignments he obtained in Scandinavia, he decided to hand over the Itzehoe workshop to his colleague Johann Dietrich Busch.

In Copenhagen Kastens built new organs in most of the city's major churches after their instruments were destroyed in a great fire in 1728. None of Kastens' instruments has survived, but in 1995, Carsten Lund attempted to re-create Kastens's first Danish organ, at Garrison Church, Copenhagen, reusing the original 1724 main facade. Other Kastens Copenhagen facades remain at Århus Cathedral (1730), Slangerup Church (1730), the Reformed Church (1728), Holmen's Church (1740) and Trinity Church (1733). Kastens's rather conservative organ style was carried on by his pupils Hartvig Jochum Müller (ca. 1716–1793) and Amdi Worm (1722–1791); in this way the Schnitger tradition was kept alive seventy years after that master's death.

Ole Olesen

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KEGELLADE

See Windchest

KEMPER

German organ firm. Emanuel Kemper (1844–1933), son of Adolf Kemper (1811–1880), who became a citizen of Lübeck in 1839, took over the workshop of Theodor Voigt in 1868 and founded the Kemper firm. Emanuel was succeeded by his son Karl Reinhold Kemper (1880–1957), who took over the firm in 1910. He was followed by his son Emanuel Magnus Kemper (1906–1978), who began working in the firm in 1944 and expanded its production to include clavichords, spinets, and harpsichords. His son, Emanuel Reinhold Kemper (b. Lübeck, 8 Jan 1947), became director of the firm on 1 January 1974; Kemper continued operation until 1978.

The company built many different types of organs and was involved in the early developments of the Organ Reform Movement. Most of their instruments espoused the neobaroque aesthetic. The firm was particularly active in northern Germany before and after World War II in building new instruments and in servicing or refurbishing a number of historic organs; its association with a number of important historic organs (especially the Schnitger at St. Jacobi, Hamburg) kept them in the public eye. Perhaps the best known Kemper instrument still in use today is the large organ at the Marienkirche, Lübeck.

Douglas E. Bush

KERAULOPHONE

A stop of quiet reedy or horny tone; its name is a composite of Greek words meaning "horn," "pipe," and "voice." In its proper form it is made from metal pipes that are pierced with a hole near the top. It may be considered a diminutive Horn Diapason. Authorities disagree as to its origin; some claim it was invented by Gray And Davison in the 1840s; others date it from late eighteenth-century Germany, where it was occasionally used for both flue and reed stops. The Keraulophone was popular during the second half of the nineteenth century, but rapidly became obsolete after the turn of the century.

See also **Horn Diapason; Stop**

Edward L. Stauff

KERN

Alsatian organ-building firm. Encouraged by Albert Schweitzer, Alfred Kern (1910–1989) founded Manufacture d'Orgues Kern in Strasbourg in 1953, grounding it on the return to mechanical action and classical organ style. He soon came to attention for his meticulous restoration of historic instruments, including those of Silbermann (Marmoutier, 1966; three manuals), Callinet (Eguisheim, 1962; 3/33), Cliquot (Fontainebleau; 1966; 3/16) and Toulouse, Cathédrale Saint-Étienne (1848 Cavaillé-Coll organ; 1970; 4/47).

By building the first large nonsymphonic twentieth-century organ in Paris using a historic case (St.-Séverin, 1963–64; 4/59), Kern proved that suspended mechanical action could be applied successfully to three- and four-manual instruments. Other large new instruments in historic Parisian organ cases are at Notre-Dame-des-Blancs-Manteaux (1964; 3/43), St.-Jacques-du-Haut-Pas (1970; 4/47), and Notre-Dame-des-Victoires (1974; 4/49). The new organs at Thionville, St.-Maximin (1969; 3/44) and Paris, St. Michael's Anglican (1976; 2/15) are other important works.

Alfred Kern received many awards for his work; his son, Daniel Kern, who had apprenticed with him and other builders, succeeded him in 1977 as director. Under his guidance instruments have been built at Dallas, University Park United Methodist (1978; 3/45); Basel, Switzerland, Theodorskirche, (1983; 3/36); Bad Homburg, Germany, Gedächtniskirche (1988; 2/19); Tours, France, Cathédrale Saint-Gatien (1996, 3/56); and Berlin, Marienkirche (2002; three manuals). Kern has also placed new instruments in Japan and Austria. The firm continues to excel in restoration, including Strasbourg, Notre Dame Cathedral (1981; 4/47); the Silbermann organ at St.-Thomas, Strasbourg (1978; 3/38) and Mondsee, Austria (1993; 3/40). In recent years, Daniel Kern has merged his efforts with Gaston Kern, whose workshop in is Bouxwiller.

Kern's usual method of construction is to build suspended playing action in classical fashion, with wooden trackers, squares, and rollerboards, in a solid wood frame. The stop action is usually mechanical, although electric stop action with a multiple electronic setter system is sometimes used for larger organs. The console is usually built into the case ("*en fenêtre*") but is occasionally detached. Low wind pressures are delivered by cuneiform bellows and the voicing is traditional in style. The firm casts pipe metal, using a high percentage of tin, and makes its own pipes.

ARTHUR LAWRENCE

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KEY

On a KEYBOARD, one of a series of levers balanced at its center or at the tail (back) end which, when depressed by a finger, sets off the ACTION, simple or complex, which admits wind into a pipe, causing it to sound. The basic concept has existed since the HYDRAULUS: by depressing a key, a three-part SLIDER with pivot was shifted so that its keyhole would line up with the pipe foot to allow air through, sounding the corresponding pipe or rank; this technology was later applied to a RANK of pipes, a kind of proto-BLOCKWERK. A rail and spring mechanism underneath the key action eased its depression and release. This technology seemed to have been lost in the early medieval era, resulting in a push-and-pull slider system; the key lever and spring mechanism had to be reinvented in the later medieval era.

At that time, organs were growing to fulfill their increasingly important ecclesiastical role; but the growing number of pipes per key and the requisite increase in wind supply made the slider mechanism difficult (and the instrument very loud). The strength needed to sound such instruments required playing the keys with fists rather than fingers; but with the development of smaller organs (from the eleventh century on) came the early stages of pallet and WINDCHEST technology. In these systems, the key functioned as a finger-operated lever, with its pivot and fulcrum located either in the middle or near its tail end; STICKERS, BACKFALLS, TRACKERS, and other components then activated the rest of the action in use. Pins were placed in the keybed to match up to holes at the bottom of the keys, assuring alignment and preventing the key from pressing down further than necessary. These systems dominated organ building into the nineteenth century, but were revived with the ORGAN REFORM MOVEMENT and especially after World War II. Electricity, which began to play an increasing role in organ building in the nineteenth century, was applied in the form of the on-off (binary) solenoid, so that contact between charged elements underneath the key was enough to produce sound.

In making keys, the main considerations are quality and the availability of a material near the location of an instrument that used it, to speed up maintenance. The woods used have included beech, birch, cherry, oak, poplar and rosewood; bone (especially cow) remains a popular material for white keys. Once the levers became true keys, the tops were extended slightly over the front edge and beveled to make it easier for the performer to distinguish keys "by feel." Other materials used in key-making have included mother-of-pearl; porcelain; tortoiseshell; silver; boxwood, cedar, pear, and other rare and polished woods; glass; and celluloid (!) and other plastics.

Whale ivory, the material of choice for the tops of white keys (ebony was preferred for black keys), was expensive, became even rarer as the whale population declined, and was finally banned in most countries; one legal stopgap is the use of ivory from the remains of mammoth and other land species. The modern color arrangement of white naturals and black accidentals has not always been automatic; at one time, the reverse pattern was more common; in other cases the accidentals used red or brown keys; but the present white/black contrast was in place by the nineteenth century. Wooden keys are varnished or otherwise protected, both as protection and to reduce finger slippage.

Keys are prone to sticking because of seasonal changes: shrinking in the cold, expanding in the heat. Also vulnerable are the various stages of the action (even solenoid connections) as well as the alignment pin. In many cases, the fix involves a subtle shifting around of components, a slight change in dimensions (in the interlocking of pin and wood), or a change in the atmosphere (e.g., a dehumidifier in a damp space). Organ key dimensions have never been subject to the standardization that today's pianos have, despite the efforts of professional organizations, but they are usually a bit shorter front to back and less wide than piano keys. In a Renaissance or Baroque organ, naturals would have ranged between 4-1/5" and 4-1/3" of visible key, versus the modern piano's 6"; organ accidentals would have been about 2-3/5", versus the piano's 3-1/2". Similarly, this same organ's octave span (measured from the extreme sides of the keys) was 6-1/4" to 6-3/5", compared with 7-2/5" for the piano.

RICHARD KASSEL

KEYBOARD

(Fr. *clavier*; Ger. *Klavier*, *Tastatur*; It. *tastiera*, *tastatura*; Sp. *teclado*; Dutch *toetsenbord*, *klavier*) A row of KEYS that activate the mechanism (ACTION) to produce the desired sounds in instruments such as the organ, piano, harpsichord, clavichord, and hurdy-gurdy. Part of the organ CONSOLE, keyboards are unique in that depressing the keys reproduces a specified note by mechanical means. (The terms *clavier* and *Klavier* are ambiguous since they may also refer to a piano as a whole.)

Keyboards with levers do not appear in original musical cultures other than Western. Keyboards were not always as they look now: two rows of keys, most often white for the diatonic notes, black for the chromatic ones, although other contrasting colors are plausible and have been used. The very first organs, beginning with the HYDRAULIS, as well as clavichords and harpsichords, had far fewer chromatic keys because (1) the lingering theoretical constructs of Guido of Arezzo used primarily diatonic notes; (2) difficulties in tuning consonances meant some notes were avoided (such as D♯, A♯, or G♭); (3) the construction and placement of pipes in early organs made it necessary to put more space between the keys; and (4) early Christian religious music (played on church organs) was composed under an interdiction against chromatic notes, said to provoke earthly passions and thus to be avoided. Until the thirteenth century, keyboards were almost diatonic except for the B-♭ that allowed transpositions among the modes, according to Guido de Arezzo's system. From the fourteenth century onward, the keyboard gradually accumulated chromatic keys (e.g., F♯), facilitating the fluctuation of the major and minor third in polyphonic music that would lead to the major and minor keys in the seventeenth century.

In the earliest organ keyboards the keys were not always levers to be depressed but were SLIDERS to be pulled out and pushed back. The dimensions of the keys were big, sometimes up to the width of 12 cm and a length of 70 to 90 cm. Keys of this type were not played with the fingers but with the fist ("hitting the organ"; a similar technique is used in the carillon.) Key widths were not standardized, in part because the arrangements were not; neither were the octave spans standardized. Sometimes this helps to determine whether an instrument is of Franco-Flemish or Italian origin.

Until around 1400, the COMPASS of an organ keyboard was limited to two octaves; it then increased to three, then attained four octaves by the mid-sixteenth century. In the lowest octave, several notes could be omitted: C♯, E♭, F♯, and A♭. These bass notes were not asked for by composers until the Baroque era. Their keys could be used for other, usually diatonic notes, saving space and costs. The so-called short octave (or broken octave) was laid out as shown below:

From about 1580 onward, keyboards were enlarged, on the organ as well as on other instruments. But the organ keyboard did not require the same extension, since different registers and multiple manuals produced the same effect. Even modern concert organs seldom exceed five octaves. In general, the key length is, at least partly, determined by the number of superposed keyboards. Some national organizations have provided standards for keyboards; elsewhere, traditions are followed, without "official" status.

Like the manual keyboard, the PEDALBOARD of an organ presents a similar disposition of (much longer) lever keys, but its compass is, of course, reduced, for the lever must be depressed by the feet and requires a greater width. For a long time, PULL-DOWN pedals were the norm, especially in England, Italy, and the Low Countries; in some countries (e.g., late Renaissance Germany) and universally by the nineteenth century, the pedalboards became independent with their own stops.

Experimental keyboards have been invented, most often to accommodate tunings outside twelve-note equal temperament. Among those specifically for organ are reversed keyboards (made by J. Mangeot for J. Wieniawski), an organ with thirty-one keys per octave (built by Adriaan Fokker), keyboards tuned by thirds, fourths, eights or sixteenths of a tone (used by Juan Carillo), and so on. Others, such as the American

	Octave														
Black	Short		AA		E♭			F♯			A♭		B♭		
Keys	Full (normal)		C♯		E♭			F♯			A♭		B♭		
White	Short	G	C	D		E	F		G			A		B	
Keys	Full (normal)	BB	C	D		E	F		G			A		B	etc.

Another example:

	Octave														
Black	Short		DD		EE			BB-♭			C♯		E♭		F♯
Keys	Full (normal)		FF♯		AA♭			BB-♭			C♯		E♭		F♯
White	Short	CC	FF	GG		AA			BB	C		D		E	
Keys	Full (normal)	EE	FF	GG		AA			BB	C		D		E	etc.

Harry Partch, took existing instruments (in his case, American REED ORGANS) and retuned them to the desired scales.

FERDINAND J. DE HEN

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KEY CHANNEL

An enclosed conduit, also called a note or tone channel, that is built into the walls of a pallet and sliderchest, by which air is admitted to individual grooves through a network of pallets, eventually exiting the channel through sliders in the "open" position into pipes belonging to one note (manual key).

As part of the ACTION, the key channel was originally opened mechanically by the depressing of a manual key. The development of pressure/exhaust pneumatic actions culminated in the electro-pneumatic chest; the two-section key channel component of this later system is described here. When wind is first supplied to the chest, the pressurized air moves through a small opening between the arms of an electromagnet into the key channel. When a particular key is not being played, gravity and equalized air pressure keep the pipe(s) from sounding. The completion of an electric circuit by pressing a key down energizes the electromagnet, which raises a small disc-shaped armature (valve, seal). As the seal is raised, wind in the first key channel section escapes, and the air therein falls to "room pressure." The now unpressurized key channel leads to a smaller chamber within the main part of the chest. This chamber is separated from the chest by a flexible membrane that in turn connects to a rod and two seals.

When the chamber and the chest have equalized pressure, gravity holds the rod/seal assembly in its lower position, preventing wind from leaving the chest. As the air from the first key channel section is exhausted by the initial change in pressure, the chamber loses pressure as well. The greater pressure in the main chest raises the rod/seal assembly; this both closes off the main chest and opens the second key channel section, releasing its wind into the room. This opening is larger than the one controlled by the magnet, allowing more air to leave and assuring the exhausted second channel sufficient differentiation from the next stage of the process, opening the main chest pallet.

See also **Pitman Chest; Stop Channel; Windchest; Wind Pressure**

RICHARD KASSEL

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KEYDESK

An older term for a CONSOLE that is attached to the pipe (main) case, rather than separate (detached console); commonly but not exclusively found in organs using mechanical ACTION.

KILGEN

American organ-building firm. George Kilgen (b Merchingen, Germany, 19 Mar 1821; d. St. Louis, 6 Dec 1902) came from a family of builders dating back to Sebastian Kilgen, who built his first organ in 1640. After an apprenticeship with Louis Voit (1802–83) in Durlach, George Kilgen came to the United States for political reasons (1840); he eventually found work with the JARDINE firm in New York. In 1851 Kilgen founded a firm there, which he subsequently relocated to St. Louis in 1873. Like Henry PILCHER, Kilgen prospered as a principal supplier to the burgeoning Midwestern market. Kilgen built two-manual tracker organs for small-town churches, averaging ten manual stops plus a Pedal with a single 16' stop. Other instruments from Kilgen's tenure include San Antonio, San Fernando Cathedral, choir organ (1884) and Detroit, St. Anne (1899, 2/11; orig. Detroit, Holy Cross Lutheran). His son Charles Christian Kilgen (b. New York, 22 Apr 1859; d. St. Louis, 6 May 1932) became a partner in 1873, creating George Kilgen and Son.

Kilgen and Son continued to build smaller tracker organs, including San Francisco, Holy Innocents, 1903 (survived 1906 earthquake) and Lewisburg, Tennessee, First Presbyterian, 1914 (2/10). However, the firm began to build larger instruments, notably over 190 theater organs, including Chicago, Piccadilly Theatre (1926) and Canton, Ohio, Palace Theatre (1926; 3/11; rest. Kegg 1992–93; one of two unaltered Kilgen theater organs in orig. location). Kilgen and Son built an organ for the St. Joseph, Missouri, Cathedral (1928; 3/19; reb, now 2/24, electro-pneum.), then built its magnum opus for New York's St. Patrick's Cathedral (1928–30; 5/177). Later instruments include Royal Oak, Michigan, Shrine of the Little Flower (1934; commissioned by Father Charles Coughlin) and the gallery and chancel organs for Bronx, New York, Our Lady of Mount Carmel (3/36 and 2/12; electro-pneum.; keyboards control both organs).

In 1910, Charles Christian purchased the John G. PFEFFER Organ Company; his son Alfred George Kilgen (b. 24 Sept 1886; d. 5 July 1974) operated it under the Pfeffer name until 1919. After Charles Christian's death, the dissension among his sons George Kilgen (1891–1972), Charles Kilgen (1895–1975), and Eugene Kilgen (1897–1867) and Alfred George became overwhelming. The Kilgen and Son firm was dissolved in 1939. Eugene formed the Kilgen Organ Company (Knoxville, Fourth Presbyterian, 1947); that firm closed in 1960. The other three brothers formed Kilgen Associates (closed 1943).

RICHARD KASSEL

KIMBALL, W. W.

American reed and pipe organ manufacturer. William Wallace Kimball, born in Rumford, Maine, in 1828, moved to Decorah, Iowa, in his mid-twenties. He became a real estate agent and accrued a considerable fortune. Before the panic of 1857 struck, he had liquidated all his investments and moved to Chicago. Kimball acquired a music store in which he sold pianos and later reed organs, establishing a network of sales agents throughout the Midwest.

In 1879 Kimball began building REED ORGANS on a limited scale, later deciding to go into full-scale production. Sales flourished, and his most successful field agent, Edwin S. Conway, received a chain of stores to supervise throughout the Midwest. In 1882 the Kimball operations were incorporated, with Kimball, Conway, and Albert G. Cone as stockholders. Kimball began building pianos in 1888; by 1889, production was fifty pianos per week and fifty organs per day. The reed organ attained the peak of its popularity in the 1890s. Kimball also produced pipe organs, and one of its outstanding accomplishments was the development of a portable pipe organ in which the longer pipes in the Pedal division were replaced by three ranks of free reeds. Another of its achievements was the remodeling of the historic Mormon Tabernacle organ in Salt Lake City.

Thereafter, reed organ sales diminished. Much of the reed organ's competition came from MECHANICAL ORGANS, such as the organette, played from either a pinned barrel or a perforated paper roll. Piano-playing mechanisms appeared, and Kimball began producing player pianos as well as phonographs. The reed organ's popularity had faded completely by the second decade of the twentieth century.

Kimball continued to build pianos and pipe organs; pipe organ production ceased in 1942. The company now concentrated on pianos, building a new factory in 1955 and acquiring the Bösendorfer Piano Company in 1966. In 1961 Kimball brought out an electronic organ for home use and subsequently became known as the Kimball Piano and Organ Company and, later, Kimball International. In 1995–96 Kimball stopped making pianos and now makes piano cabinets for other pianomakers; the firm continues as Kimball International.

JAMES HOWARD RICHARDS

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KING, WILLIAM (1835–1923)

Irish-born American organbuilder. Born on 3 April 1835, King apprenticed with Henry ERBEN in New York City around 1850 and by 1865 had established his own firm in Elmira, New York. He is also said to have worked for William Robjohn (1803–1878, brother of Thomas ROBJOHN) in Elmira (ca. 1862), but it could not have been a lasting relationship. In 1889, he took his son, William B. King, into partnership, although they went bankrupt just eleven years later. King then moved to Chicago, where he became a representative for HOOK AND HASTINGS, retiring around 1918. He died in Chicago on 1 October 1923.

King organs were solidly built, competently voiced instruments, marketed primarily to clients in southern New York State, northern Pennsylvania, and Philadelphia. Among King's largest organs, all three-manual, were those for Elmira, First Baptist (1892), Elmira, New York State Reformatory Chapel (1893), Bethlehem, Pennsylvania, Presbyterian Church (1889), Philadelphia, St. Matthew's Lutheran (1891), and Philadelphia, St. Simeon's Episcopal (1893).

STEPHEN L. PINEL

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KINURA

An 8' or 4' reed stop of the Regal class, invented by Robert HOPE-JONES and found almost exclusively on theater organs. Few sources outside the theater organ

world have anything complimentary to say about the tone of the Kinura, likening it to a thin or poorly voiced Oboe. The phrase "bee in a bottle" is often encountered. Often called the clown of the theater organ, it is rarely used by itself.
See also **Stop**

EDWARD L. STAUFF

KJERSGAARD, MADS (B. 1944)

Swedish organbuilder and organ historian of Danish birth. Born in Copenhagen on 26 December 1944, Kjersgaard has lived and worked in Sweden since 1962. He established his firm in Gunsta, near Uppsala, in 1967. It is managed solely by the founder; when necessary for bigger projects, he works with Robert Gustavsson's organ-building factory in Härnösand.

Kjersgaard's workshop builds small instruments modeled after Renaissance and early Baroque organs. His recent instruments include the reconstruction of the sixteenth-century organ in Sønderborg Castle (1996) and a Renaissance-style instrument in the case at Gottorf Castle Chapel in Schleswig, Germany (2002). Restorations include the Jochim Richborn positive (1667) in Skokloster Church, Sweden; the Nicolaus Manderscheidt positive (1645–50) at Skaraborgs Länsmuseum, Sweden; the "Hoff organ" (Jonas Rosendal, 1723) in Norsk Folkemuseum, Oslo; and the Esajas COMPENIUS organ (ca. 1610) in the chapel of Frederiksborg Castle, Denmark (collab. J. Ahrend, 1988).

Kjersgaard has contributed technical and analytical research to many well-known organ publications. His studies of the unique medieval organ relics in Stockholm and the puzzling organ ruin in Sønderborg have given him a prominent position in international organ archeology.

OLE OLESEN

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KLAIS

German organ-building family. Johannes Klais (1852–1925) established Johannes Klais Orgelbau in Bonn (1882); his successors have been his son Johannes Klais (1890–1965), his grandson Hans Gerd Klais (b. 1930), and his great-grandson Philipp Klais (b. 1967). The latter two were trained by their respective fathers; Philipp also worked at the Muhleisen firm in Strasbourg.

Klais originally used mechanical action, turning to pneumatics in 1897 and electro-pneumatics after 1906. A return to mechanical key action has been the norm since 1948, often with electric stop action. Recent output has tended to synthesize historical and contemporary elements. Some of Klais's more prominent installations are (in Germany unless otherwise indicated): Würzburg, Kiliansdom, 1969 (5/128); Berlin, St. Hedwig's Cathedral, 1976 (3/92); Ingolstadt, Liebfrauenmünster, 1977 (4/105); Limburg Dom, 1978 (4/84); Cambridge, England, Gonville and Caius College, 1981 (3/47); and Kyoto, Japan, Concert Hall, 1995 (4/90); Cologne Cathedral, 1998 (3/53); Seoul, So. Korea, Presbyterian Church, 2003 (3/57); St. Petersburg, Russia, Philharmonic Hall, 2004 (3/59); and Nürnberg, St. Lorenz, 2005 (3/32). Organs in the United States include Big Sur, California, Norman-Clement residence, 1971 (2/19); New York, St. Peter's Lutheran, 1977 (2/43); Delaware, Ohio, Wesleyan University, 1980 (4/82); Grosse Pointe, Michigan,

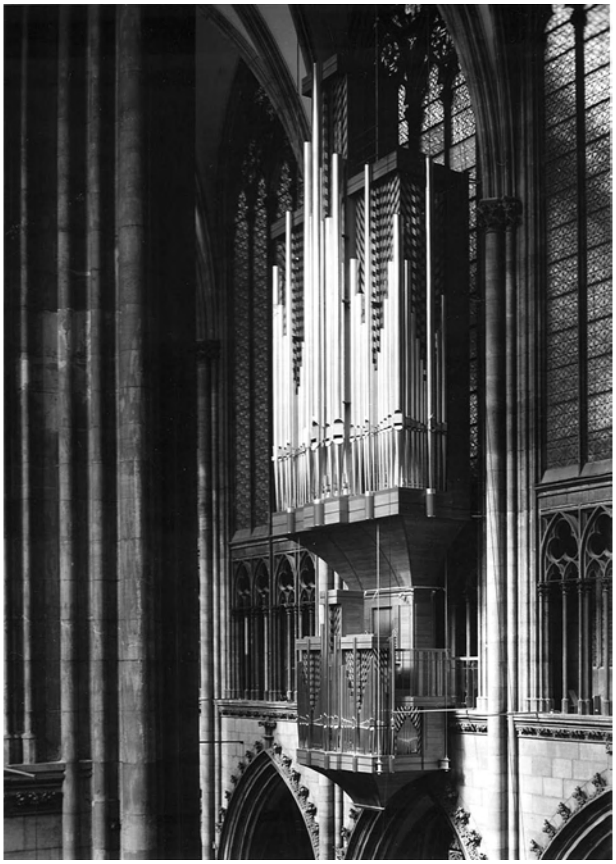

Fig. 53. Klais organ, 1998 (3/53), Cathedral, Cologne.

Memorial Church, 1989 (3/66); and Irvington-on-Hudson, New York, Presbyterian Church, 2001 (3/35); Madison, Wisconsin, Overture Hall, 2004 (3/65); and Richardson, Texas, First United Methodist Church, (4/58). Most of the company's restorations of older organs have been in Germany.

Arthur Lawrence

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KLEMM, JOHANN GOTTLOB (1690–1762)

German-born American organbuilder. Although the son of an organist and organbuilder, Klemm, born near Dresden on 12 May 1690, pursued theological studies in Freiburg (ca. 1705) and at the University of Leipzig. Having learned "nothing but evil," he returned to Dresden around 1710 to pursue instrument making, possibly working briefly with his father. Between 1710 and 1726, Klemm built and repaired stringed keyboard instruments (and possibly organs), and may have met Gottfried Silbermann, who had built an organ for Dresden's Sophienkirche in 1720.

By 1724 Klemm had met with Count Zinzendorf, patron of the Unitas Fratrum, or Moravian Church, who commissioned Klemm to build him a harpsichord. For a brief time Klemm and his family joined the Brethren in Herrnhut, Saxony, but, disillusioned once again, emigrated to Philadelphia in 1733. Klemm set up as a keyboard instrument maker. He is often credited as being the first to pursue a full-time trade in this manner in the American colonies.

A number of organs are attributed to him, including a twenty-six-stop organ he built for New York, Trinity Church (1741; one of the largest organs he produced) and a one-manual instrument for Philadelphia, Gloria Dei Lutheran Church (also known as "Old Swedes"; ca. 1737). Two years following the death of his wife in 1743, Klemm moved to New York; by 1757, he was residing in the Moravian community of Bethlehem, Pennsylvania, where he worked closely with the young David Tannenberg. While in Pennsylvania, he constructed several organs, including two in Nazareth (1758 and 1759), one in Bethlehem (1759), and another in Christian's Spring (1760). Klemm died in Bethlehem on 5 May 1762.

Thomas Cimarusti

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KNEY, GABRIEL

See Canada

KNIPSCHEER

Family of Dutch organbuilders. Hermanus Knipscheer I (chris. Dordrecht, 18 Feb 1772; d. 29 Mar 1833) came to Amsterdam and was almost certainly apprenticed to the organbuilder Dirk Johan Baars. After Baars's death in 1796, Hermanus probably took over his business. He built various types of small house organs (including some "latafelorgels," perhaps similar to the more widespread "secretary organ"), the smallest with only two stops. Knipscheer also built church organs in Berkel (1810), Amsterdam (Oosterkerk, 1817), and Amstelveen (Reformed Church, 1818), none of which survives. The Gemeentemuseum in The Hague owns a bureau organ signed by Knipscheer; a few other instruments are attributed to him. In 1830, the firm built an extraordinarily rich cabinet organ for its time (1/10; private collection).

His son Hermanus Knipscheer II (b. 28 Aug 1802; d. 24 Feb 1874) entered into partnership with his father in 1825, and succeeded him after his death. Hermanus II was a prolific builder of house organs, many of which survive. In addition, he built thirty-two church organs, most of them two-manual instruments with fifteen to twenty stops on Hoofdwerk and Bovenwerk, with or without Pedaal stops. The specifications are highly standardized. The organ in Wormerveer, Zandvoort (Reformed Church, 1849) has the following specification: Hoofdwerk: 16.8.8.4.3.2.III-V[B/D].IV[D].8[B/D]; BW 8.8.8.4.4.2.8; Ped. 16.8 (B = bass, D = discant of divided stops).

Hermanus II's organs were tailored to lead Dutch psalm singing: the Cornet, the descant of the Mixture, and the Trumpet enabled the organist to bring out the melody strongly, while the quieter Bovenwerk served for interludes. A remarkable indication of salesmanship is that he was able to build his organs on supply and was therefore able to meet demand quickly. Many Knipscheer organs can still be found in the Amsterdam region, including Noordwijk-Binnen, Grote of St. Jeroenskerk (1840; 2/17/pull-down; Bovenwerk repl. Positief, 1885; Pedaal added, 1904; rest. Flentrop, 2000; now 2/22). His largest organ was for Amsterdam, Noorderkerk (1849; 2/28; extant). He started maintaining the Müller organ at St. Bavo's, Haarlem in 1853; from that moment on, he signed his letters "restorer of the Haarlem organ." Four of his sons, including Hermanus Knipscheer III (1826–1896), were active in the organ and piano trades.

JAN-PIET KNIJFF

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KOENIG

Alsatian organ-building family. Jean-Georges Koenig (1920–1992) apprenticed with, then worked for Strasbourg builder Edmond-Alexandre ROETHINGER (1934–43); he founded his own business in 1945 in Sarre-Union, in Henri Vondrasek's old workshop. For the first twenty years the business limited itself to small rural organs, often with electrified tracker action. It was not until 1967, with the reconstruction of the organ of St.-Georges in Sarre-Union, that Koenig was able to fully demonstrate his abilities: he had installed a new organ (2/31), constructed according to the principles laid down in *L'art du facteur d'orgues* by François BÉDOS DE CELLES, inside an original Baroque organ case. This instrument gained Koenig recognition as a specialist in French classical organs and commissions to build new organs in the same style at Amsterdam, Open University (1973; 4/35) and Pierrefonds (1979; 4/33).

With Alfred KERN and Curt Schwenkedel, Koening was one of the main representatives of Alsatian neobaroque organ building, as witnessed by his new organs for Saarebourg, St.-Barthelemy (1969; 3/33), Paris, Temple of Auteuil (1971; 2/15) and Angers, Bon Pasteur (1972; 2/16). He restored instruments at Lorris-en-Gatinais (1501; 3/30; 1975) and at Micot de Vabres-l'Abbaye (1762; 4/47; 1986). From 1975 on his son Yves Koening (b. 16 May 1950) played an important role in the business; by 1983 he had succeeded his father upon the latter's retirement. The 1980s were marked by important restorations at Joinville, 1688 Lebe organ (1984; 3/30), Rodez Cathedral, 1676 Joyeuese organ (1986; 4/47), and Nemours (1653/1744; rest. 1988; 3/28). Koenig performed reconstructions of historical organs at Saint-Nabor de Saint-Avold (1987; 4/39, French classical style) and at Strasbourg, St.-Guillaume (1987; 2/30, after Gottfried Silbermann). Beginning with his new organ in Osaka, Japan, Izumi Hall (1990; 4/46), Yves Koening has concentrated on the building of new organs, less historical and more versatile, such as St.-Nicolas de Sarreguemines (1992; 3/29) and Charleville-Mezieres (1997; 3/40); he now works primarily in Germany and Luxembourg.

CHRISTIAN LUTZ

Translated by Moira Tierney

KOPPEL/KOPPELFLÖTE

(1) Metal or wood Gedeckt.
(2) A (usually open) metal Flute, 8' or 4' (manuals); a truncated conical shape on top, otherwise a cylinder pipe made of spotted metal or a tin-lead alloy; dates from the Renaissance on. More a combination than a solo stop, its liquid sound has elements of the Gemshorn.
See also **Copula**

KRATZENSTEIN, CHRISTIAN GOTTLOB (1723–AFTER 1795)

German academic and inventor. Born in Wernigerode, Kratzenstein was a professor of philosophy and medicine. He lived in St. Petersburg until the 1750s, then moved to Copenhagen. In 1780 he won the prize of the Academy of Sciences of St. Petersburg with an essay demonstrating the acoustic principles of the vowels. Proving it was possible to imitate a speaking human voice with organ pipes, he constructed a machine using FREE REEDS (first in Europe) and resonators of different form and size.

While Kratzenstein was apparently aware of the Asian MOUTH ORGAN, he constructed a new model of this kind of reed; the tongue lay in the same horizontal plane with the frame, but was fixed above the frame and therefore had different acoustic properties than the Asian type. Even for his earliest free reeds Kratzenstein used voicing devices such as would be found on lingual organ pipes. He died in Copenhagen after 1795.

The principles of free-reed pipes were soon adopted and promoted by the German organ player and theorist Georg Joseph VOGLER, who made considerable use of free reeds in his ORCHESTRION, with which he toured Europe. After 1800 Kratzenstein's invention led to the construction of several instruments using free reeds without RESONATORS (mouth organ or harmonica, accordion, concertina, harmonium, and REED ORGAN).

CHRISTIAN AHRENS

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KRONWERK/POSITIV DE COURONNE

A Positiv division ("crown division") located at the top of the case rather than behind the organist, a smaller late Baroque and Romantic successor to the "upper division" (Oberwerk) placed above the Hauptwerk or at the Récit level of the Grand Orgue. Different qualities have been assigned to this division—lively, even aggressive, or distant and echolike—but the stops chosen for it supplement those of the larger divisions.

KRUMMHORN

One of the earliest organ stops, first appearing in the late 1400s; also called Kromhoorn, Cromorne, Cormorne, and Crumhorn. It has varied in construction and timbre over the centuries. It takes its name from the instrument, a capped reed with a curved body and a muffled, buzzing tone; the organ stop in its most familiar form has a tone anticipating that of the Clarinet, which did not develop until the early 1700s. In the classical French organ, the Cromorne was the essential reed of the Positif, whether that Positif contained other reed stops or if other divisions might contain Cromornes. The Cromorne was used as a solo or a combinational stop, was often specified in composition titles, and dominated the Grand jeu of the Positif. It was usually made with narrow cylindrical half-length resonators. *See also* **Stop**

Edward L. Stauff

KUHN

Swiss organ-building firm. Johann Nepomuk Kuhn (b. Waldsee, Württemburg, Germany, 17 May 1827; d. Männedorf, 21 Dec 1888) apprenticed with Carl Weigle of Stuttgart-Echterdingen (1851–54). He and Heinrich Spaich worked for E. F. Walcker in Ludwigsburg; they were sent to Männedorf, Switzerland, to install an organ in the Protestant church in 1863, and then decided to stay and open their own business a year later. They worked together until 1872, after which Kuhn continued alone.

Kuhn soon gained an excellent reputation in Switzerland, building organs with cone-valve windchests, either purely mechanical or with Barker levers, and he frequently employed neobaroque or other neohistoric cases. The tonal ideal embodies the qualities of the South German Romantic style. He became a naturalized Swiss citizen in 1877. He built about seventy-five new instruments.

His son (Carl) Theodor Kuhn (b. Männedorf, 16 June 1865; d. there, 23 Oct 1925) first apprenticed in his father's firm, then continued studies in Germany, France, and North America; he was fascinated with the work of Aristide Cavaillé-Coll. His father's death brought him back to Männedorf to take over the business, where he experienced much success and expanded business operations. A technological change approach occurred with Kuhn's replacement of mechanical action with pneumatics. In 1891 he received a patent for his pneumatic designs and built his first pneumatic instrument for the church in Thusis (2/15). Remaining very much interested in French organ building, he opened subsidiaries in Bellegarde, Ain (1896) and Nancy, Meurthe-et-Moselle (1906). World War I interrupted these businesses and eventually led to the selling of both French subsidiaries.

Already seriously ill and deeply concerned over the continuity of his business, Theodor Kuhn, together with Gottfried Aschmann and Emil Walch, established Orgelbau Kuhn AG (Theodor Kuhn Organ Builders, Ltd.) in 1925 as a jointly held company. During his life Kuhn built about 530 new instruments; though he built pneumatic organs almost exclusively, he saw the beginnings of the return to the use of mechanical actions. His organs continued the South German character of his father's instruments, combined with elements of the French style, particularly in the use of reeds and strings.

The work of Orgelbau Kuhn may be divided into three distinct eras that flowed freely from one to the next. The era of director Philipp Ziegler (1925–38) had to come to terms with the beginnings of the Organ Reform Movement and the Alsatian reforms in particular. Of special significance was the rebuilding of the Bern Cathedral organ, where the company first employed slider-chests and a Rückpositiv, albeit with electric action. The first Kuhn mechanical action organ with slider-chest was built in 1937 for Fribourg. During the period of Jean Walch's leadership (1938–60), practically only slider-chest instruments were built, most of them with mechanical action. Larger instruments were equipped with Barker lever machines to assist the tracker action or built with electric action. Activity in these first two eras was largely confined to Switzerland.

Friedrich Jakob's directorship (1967–99) saw four successive developments: (1) the consolidation of reforms so that new instruments are built only with mechanical action, although elements of Romantic symphonic organs remained under study; (2) the founding of a corporate subdivision devoted solely to restoration projects (1975); (3) the opening up of international markets; and (4) the expansion within the firm to work with for instruments of all significant periods and styles. Orgelbau Kuhn AG is currently led by general director Dieter Utz (b. 11 Feb 1956). Recent projects organs include: Winterthur, Switzerland, Stadtkirche, rest. 1888 Walcker organ (1984; 3/56); St. Urban, Switzerland, former monastic church, rest. 1716/1721 Joseph Bossard organ (1993; 3/40); Tokyo, Opera City, Shinjuku (1997; 3/54); Hamburg, St. Johanniskirche Altona (1998; 3/48); Lübeck, Germany, Herz Jesu Kirche (1998; 3/29); Bern, Switzerland; Cathedral (1999; 4/71); Porto, Portugal, San Martino (2000; 3/36); Treviso, Italy, Cathedral (2000; 3/49); and Bozen, Italy, Monastic Church Muri-Gries, rest. 1907 Anton Behmann organ (2001; 2/27).

Dieter Utz

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L

LABIAL

Another name for the FLUE pipe classification, meaning "lip." While most flue stops fit comfortably into this type, there are a small number of "labial reeds" that, while designed like flue pipes, approximate reed stops to varying degrees.

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LADEGAST, FRIEDRICH (1818–1905)

German organbuilder. Ladegast was born in Hochhermsdorf (now Hermsdorf), near Geringswalde, on 30 August 1818. Son of a carpenter and cabinet-maker, Ladegast received his early training in his brother Christlieb´s workshop in Geringswalde; he built his first two organs there at age twenty. He learned further organ-building skills in Saxony, in Leipzig with Johann Gottlob Mende (1787-1850), in Borna with Urban Kreutzbach, in Dessau with Adolph Zuberbier (1778-ca. 1850). and in Martin Wetzel's Strasbourg workshop, where Ladegast was introduced to the Johann Andreas Silbermann school.

The climax of Ladegast's journeyman years was his work with Aristide CAVAILLÉ-COLL in Paris. A long-lasting friendship with the great French builder would have a favorable influence on the designs of Ladegast's organs. In 1846 Ladegast founded a workshop in Weissenfels, but he had to wait until 1849 to receive his first contract for a small organ in Geusa near Merseburg. He incorporated the Barker lever for the first time in the instrument at Leipzig, Nicolaikirche. He also borrowed other Cavaillé-Coll technical innovations, such as pneumatic stop drawers and swell pedals, which Ladegast used for the first time in the Schwerin Cathedral organ and at the time caused a sensation in German organ-building circles.

However, Ladegast rejected pneumatic action, though his son Oskar (1858–1944) would introduce it after 1890. In this connection, other well-known firms, like Wilhelm SAUER, E. F. WALCKER, and Ernst Röver, were already one step ahead, and the Weissenfels workshop suffered. By the end of the nineteenth century, taste in organ music had changed so much that the sound of Ladegast's organs was thought to be too "straight" and out-of-date.

A list names some two hundred organs that Ladegast had built up to 1897. In addition to big organs with more than eighty stops, Ladegast built instruments with between seven and fifteen stops. In addition to Germany, he was soon exporting to Austria, Estonia, Poland, Russia, and Spain, and even to South Africa and the United States (New York). While his professional and artistic success was great, his financial gain was often modest.

In 1898 Friedrich Ladegast handed the firm, called Friedrich Ladegast and Son since 1888, over to Oskar; Friedrich died on 30 June 1905. After a period of decline following World War I, the workshop was closed in 1937. In a letter to the Merseburg Cathedral organist Hans-Günther Wauer, dated 26 July 1958, Albert SCHWEITZER wrote, "I consider Friedrich Ladegast to be the most important organbuilder in Germany since Silbermann, whose tradition he continues."

ALEXANDER KOSCHEL

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LANGHEDUL

Brabantine family of organbuilders, active in Ypres/Ieper (West Flanders). The founder of the dynasty was Victor Langhedul (d. ?1513), who worked at the churches of St. Omer and Lille (then part of the southern Netherlands). His workshop was continued by his son-in-law Matthijs de Wulf (fl. 1515-1522) and his son Michiel Langhedul I (d. after 1570), who traveled to England around 1530 and worked on the Salisbury Cathedral, Trinity Chapel organ. Michiel I returned to Flanders, where he built an impressive number of large and small instruments, in cities such as Bruges (1535), Veurne (1536, 1557), Nieuwpoort (1553, 1557), Dunkirk (1555, 1559), and Poperinge (1569), as well as in numerous small villages. He was among those who built new organs to replace those destroyed by the Iconoclasts during the Reformation. Jan Langhedul (d. Ghent, 1592), son of Michiel I, went to France to escape political and economic difficulties. He first worked in Lille, then went to Paris in 1585, where he restored many organs. For his work on the organ of the Ste.-Chapelle, Henry IV bequeathed him the title *facteur d'orgues du Roy*. He later returned to Flanders. Another son Michiel Langhedul II, is only known to have been active in Hazebrouck (ca. 1610). It is not clear whether Guillames Langhedul (fl. 1590–1595), who worked with Jan Langhedul, was his brother or his son.

Matthijs Langhedul (d. 1635 or 1636), a third son of Michael I, was undoubtedly the most important builder of the family. He went to Spain, working as organ tuner at the Spanish court. He went to Paris in 1599, where he restored several organs (e.g., St.-Jean-en-Grève, St. Benoît). The latter instrument organ had been made by Jan with a spring-chest; Matthijs replaced this with a slider-chest, for easier repair. His most important organ was for Paris, St.-Gervais (1599–1601; 2/22). In 1605 Matthijs returned to Ypres and later settled in Brussels, serving as court organbuilder for Albert VII and Isabella. There he built also organs for Hondschote (1611), Antwerp, Cathedral (1637; 1/10/no ped.), Tongeren (1618; destr. 1678), and Madrid.

From the late fifteenth century until Matthijs's death, the Langhedul family played an important role in the development of the Franco-Flemish organ in the late Renaissance. Jan and Matthijs Langhedul, along with Crespin CARLIER, can be said to have laid the foundation for the later French classical organ.

FERDINAND J. DE HEN

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LANGUID

The portion of an organ PIPE that divides the FOOT from the body and is responsible for the creation of the wind sheet that, in turn, is responsible for the generation of the pipe's tone. The languid is usually a flat piece of metal, generally comprised of 97 percent lead or so, soldered horizontally to the top of the pipe foot. The body of the pipe is soldered to the languid (and foot) to create the completed pipe. Tapering from front to back, the languid is beveled to a specific angle at the front edge, with a small gap left between the back of the lower LIP and the front edge of the languid. This rectangular hole is the width of the pipe MOUTH and is the area though which the wind is formed into a sheet and blown upward to strike the upper lip of the pipe, thereby generating the tone specific to that pipe.

In some cases, especially in THEATER ORGANS, the languid is "pocketed" or "scalloped": a sealed cylindrical tube is soldered to the bottom of the languid, into which a round hole has been cut. This gives the languid a "well" in its center descending some way into the foot of the pipe.

The angle to which the languid is beveled can range between 45° and 75° from the horizontal and can be treated in a number of ways. This is usually done to counter the generation of the "sizzling bacon" effect ("white noise") in the organ pipe's speech. The simplest (and oldest) of these is the *Gegenphase* ("counterphase"), which refers to a thin (at times microscopically so) counter-bevel being planed to the leading edge of the languid (usually at 90° to the horizontal). Other techniques include NICKING, where small slits are made in the languid's leading edge to create eddies in the sheet, and "dubbing," where the edges are smoothed over to remove any sharp corners.

See also **Acoustics**

David Smit

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LANTERN BELLOWS

See Bellows

LARIGOT

See Nineteenth/Larigot

LAUKHUFF

German organ parts supply company. Martin Andreas Laukhuff (1798–1871) trained with Johann Eberhard Walcker and worked with his famous son, E. F. Walcker. Laukhuff set up shop for himself in 1823 in Cannstadt, transferring the workshop in 1842 to Pfedelbach. There he had three sons, all of whom entered the organ-building trade. The eldest, August Laukhuff (1850–1886), took over the operation in 1871 and manufactured pipes and organ parts of the highest standard. After his early death his brother Andreas Laukhuff (1858–1933) took over the operation, transferring the workshop to a bigger building in Weikersheim and developing international business contacts. They continued to produce organ parts, offered worldwide by catalog; the catalog business was an innovative idea, and was successful. In 1933, Andreas's sons Otto Laukhuff (1898–1989) and Wilhelm Laukhuff (1903–1981) took over the operation; they rebuilt it after it was destroyed during World War II. In 1972–73 the company was handed over to Otto's son Hans-Erich Laukhuff (b. 1944) and Wilhelm's son Peter Laukhuff (b. 1937). Laukhuff is the largest supplier of pipe organ parts in the world.

Christoph Keggenhoff

LAURIE, STEPHEN J(AMES) (B. 1914)

Australian organbuilder of English birth. Born in Harrow, Laurie apprenticed in 1930 to the John H. Compton Organ Company, London; he emigrated to Australia in 1948 and joined George Fincham and Sons, Melbourne, in 1953 as a voicer and tonal finisher. In 1957 he established his own firm in Victoria, entering a partnership with Keith Davis of Launceston, Tasmania (1961–65).

Laurie Pipe Organs has carried out almost 150 major projects in five Australian states since 1958, including forty-seven new organs. While specializing in unit organs based on the Compton model, the firm has received a number of larger contracts, including that for St. Andrew's, Brighton, Victoria (1964; 4/63). While electro-pneumatic action has dominated production, several mechanical action instruments have been built or restored. Although Stephen Laurie retired in 1998, the firm continues to operate under the direction of his former employees, trading as S. J. Laurie Pty. Ltd.

Kelvin Hastie

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LEAD

See Pipe metal

LEATHER

Leather comes from the hide (occasionally other parts) of sheep, goat, cabretta (a hybrid of sheep and goat), lamb, deer, elk, cow, and kangaroo; suede and gut are also used. Tanned (aged) animal hide has served many purposes in organ building for well over a millennium. Leather acts to seal connections so they will be airtight, and to protect parts from damage. The surfaces to which the leather attaches have to be sanded, sized with fish glue or other adhesive, or otherwise prepared for a successful fixing. There are two thicknesses of leather divided among three categories: heavy, fixed leather for connections between larger valves; heavy, flexible leather for bellows, larger electro-pneumatic pouches, and other flexible joints; and thin, flexible leather for use in small electro-pneumatic motor pouches. The thin leathers are subject to faster wear; silicone coating increases their longevity. Felt is sometimes added to thin leathers.

Organbuilders need materials that can withstand thousands of bellows blows, key and pedal movements, slider and tracker actions, pallet ups and downs, pneumatic air transmissions, and other repetitive motions. Most builders will have nothing to do with plastics, although such products exist; the materials are in their experience not durable enough. Longevity is also a concern for the owner of an instrument; builders' expectations are that leathering should last at least twenty years in polluted urban areas, and perhaps up to fifty years in suburban and rural areas. Besides poor air quality, excessive heat and cold and rapid temperature changes will hasten the deterioration of the material.

The premature failure of leathering, or the necessary reupholstering as part of restoration after decades of neglect, can prove both expensive and demanding. Depending on the instrument, one may have to remove old leather from and put in new leather for RESERVOIRS, bellows, SCHWIMMERS, and other REGULATORS, electropneumatic motor pouches that open pipes or initiate other actions (e.g., combination action, SWELL shade, pallet box purse), TREMULANTS, or relay and CONSOLE switches.

See also **Action**

RICHARD KASSEL

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LEAVITT, JOSIAH (1744–1804)

American organbuilder, organist, and physician. As a young man, Leavitt's interest in organ building drew him to the workshop of Thomas JOHNSTON. While working as a physician in Sterling, Masssachusetts, Josiah built his first organ in 1786, heralding a tradition of New England organ building in the United States that would continue under William M. GOODRICH.

After living in Maine for several years, Leavitt moved to Boston, where he spent the majority of his organ-building career. Some of his work may be viewed as experimental, such as his combination organ-harpsichord (a kind of CLAVIORGAN) in which each instrument could be played separately or simultaneously. Other work is firmly grounded in eighteenth-century style, such as the 1793 one-manual organ at Boston, First Universalist (Open Diapason 8', Stop T Diapason 8', Principal 4', Twelfth 2-2/3', Fifteenth 2', Sesquialter, and Trumpet 8'). Though Leavitt was a Congregationalist (a denomination that did not use instruments in its services at the time), he often constructed organs at the request of other denominations. Representative Leavitt organs can be found in Dedham, Masssachusetts, Episcopal; Hartford, Connecticut, Worthington Parish; and Newburyport, Massachusetts, First Congregational.

JARED DONG

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LEFÈVRE

French organ-building family; also spelled Lefèbvre and Lefebvre. Builders included Antoine Lefèvre I (1500–1551); his son, Guillaume Lefèvre (fl. 1572–81); Antoine Lefèvre II (fl. 1612–50); Clément Lefèvre (1630–1709); his son, Germain Lefèvre (chris. 1656; d. 1694); Pierre Lefèvre (1670–1737); (Louis) Charles Lefèvre (chris. 1670; d. 1737); Louis Antoine (André) Lefèvre (1700–1763); and Charles's son, Jean-Baptiste Nicholas Lefèvre (chris. 1705; d. 1784). Relationships among members of the family are often uncertain. The Lefèvres lived in Rouen (Seine-Maritime); most of their known work is in this region. Most Lefèvre reconstructions and restorations of their work have reincorporated full mechanical action.

Antoine II built an organ for Toulouse, Cathédrale Saint-Étienne, between 1612 and 1650 (reb. Cavaillé-Coll, 1848; rest. Kern, 1970; 4/47); restored a 1427 Jacques de Rasta organ at Bordeaux, Cathédrale St-André (1619; repl. Valéran de Héman, 1627–35); and, with Desenclos, completed a De Héman instrument, the so-called Richilieu organ, for Mitry-Mory, St.-Martin (1651; 3/24; rest. L.-A. Cliquot, 1750; reb. Dallery, 1813; 4/30; reb. Mutin, 1876). A century later, Charles was active as builder and restorer: Rouen, St.-Vivien (1710; reconstr. Krischer, 1898; rest. Lavergne, mid-twentieth c.; now 3/31); Rouen, St.-Ouen, rest. 1630 Carlier organ (1724; reb. Cavaillé-Coll, 1888–90; rest. Beuchet-Debierre, 1955, as Cavaillé-Coll organ; now 4/64, mech./pneum.); Rouen, St.-Nicolas (incorp. 1631 Lessélier organ; 1732; 3/22; to Hospice Général Charles Nicolle, 1801; rest. Benoît/Sarélot, 1981–85; now 3/25); and Rouen, St.-Maclou (reconstr. 1518–21 N. Castille organ; reconstr. Kern, 1998; 3/36). By 1731, Jean-Baptiste Nicholas had joined his father; they built organs for Rouen, Temple St.-Eloi (1731) and Montivilliers (1746; moved to Fécamp, Abbey, 1793; reb. Cavaillé-Coll, 1883; rest. J.-M. Cicchero, 1997; now 3/35, mech.).

Jean-Baptiste Nicholas Lefèvre came into his own during the latter part of the French classic era; as often occurs in late stylistic stages, his instruments were unusually large for their type. He was among many builders acquainted with François BÉDOS DE CELLES, who reported on Lefèvre's instrument for Tours, St. Martin (1761; 5/65) in Jacob Adlung's *Musica mechanica organoedi* (1768). His other work includes Rouen, St.-Sacrement (rest. anon. 1677 organ; repl.

Cavaillé-Coll–Mutin, 1923); Caen, St.-Étienne (with Louis Antoine Lefèvre; 1737; 5/?63; reb. Cavaillé-Coll, 1882; now 3/50, pneum.); Rouen Cathedral (reb. 1683 R. Cliquot organ; 1748; 4/44; rest. Bédos de Celles 1776–78; destr. 1940); Tours, Cathédrale St.-Gatien (reb. anon. 1521/1733 L.-A. Cliquot organ; 1764; reb. R. Cliquot, 1785; 4/43; reb. Gloton-Debierre, 1928-29; electro-pneum.; rest. Kern, 1992–96; 3/56, mech.); Evreux Cathedral (reb. anon. sventeenth-c. organ; 5/51; destr. 1940); Honfleur, St. Catherine (1770s; reb. Mutin, 1880; rest. Gonzalez, 1979); and Montivilliers (1784; reconstr. Debierre, 1892; electro-pneum.; rest. Thibaud, 1990–91; 3/35). Lefèvre also revisited an instrument he had worked on with his father: Rouen, Temple St.-Eloi (reb. 1774; reconstr. Haerpfer-Ermann, 1979; 4/38).

RICHARD KASSEL

LE PICARD

Family of organbuilders active in France and Flanders; also called Le Picart. An early representative of the family, Philippe Le Picard I (b. between 1620 and 1630; d. Noyon, 1701 or 1702) built a new organ for Montdidier (1667) and restored the organ in Amiens Cathedral (1671). With his son Antoine Le Picard (fl. 1685–1716), Philippe enlarged the organ at Liessies (1693–95) and restored the organ in Noyon Cathedral (1698). In 1685 Antoine built a new organ for St. Hubert Abbey (3/36; case extant). Philippe Le Picard II (b. Noyon, between 1650 and 1668; d. Liège, 15 May 1729), another son of Philippe Le Picard I, enjoyed a fine reputation and worked on three Liège instruments: St. Pierre (1702), St. Lambert's Cathedral (1705), and Ste. Croix (1716). His only surviving instrument dates from 1711 and is in Gronsveld, Netherlands (near Maastricht).

Jean-Baptiste Le Picard (chris. Liège, 23 May 1706; d. Metz, 18 May 1779), son of Philippe Le Picard II, became an accomplished builder of organs in the French classical style. His instruments included divisions with a short manual compass (Récit, from c'; Echo, from c); the pedals used a pull-down system. His organs include: Maastricht, Dominicanerkerk (1734-35), built with his brother Jean-François Le Picard (chr. 18 Oct 1711; d. Metz, 21 April 1784); Liège, Benedictine Abbey (1736–37); Vlierbeek Abbey (1737–38); Liège, St. Pierre (1739–41; case extant); Beaufays Abbey, near Liège (1741–42; extant); Nunhem, near Roermond (1742; two manuals, pull-downs; Positif moved to Groningen, Martinikerk); Kuringen, Herkenrode Abbey (1744–46); Roermond (ca. 1745; now in Utrecht, Gereformeerde Oosterkerk); Roermond, Groot-Seminarie (1745; case and seven stops extant); Hodimont (1747); Roermond Cathedral (1750–52; three manuals, pull-down); Tongeren, Onze Lieve Vrouwbasiliek (1750–52; case extant); and St. Truiden Abbey (1753–56). Joseph Le Picard (chris. Liège, 14 July 1704), another son of Philippe Le Picard II, worked in Metz as an organbuilder.

DOUGLAS E. BUSH

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L'EPINE (LESPINE)

Family of classical French organbuilders. (Jean) François L'Epine I (b. Abbeville, 1681 or 1682; d. 1762) and Adrian L'Epine, brothers, learned organ building in the Netherlands. As Protestants, they fled France at the revocation of the Edict of Nantes but returned around 1711 and set up in Bordeaux, where they restored the cathedral organ that year. In 1724 they restored the instrument at St. Jean de Luz. They ceased their partnership in 1727. François moved to Toulouse and constructed an organ for the Cordeliers; the following year, he restored the organ of Rodez Cathedral. Adrian, after restoring the instrument at St. Michel, Bordeaux (1731), returned to Abbeville. In 1747, François was involved in the restoration and enlargement of the Albi Cathedral organ, built by Christophe Moucherel just ten years earlier.

Jean-François L'Epine II (1732–1817), son of Jean-François L'Epine I, studied and worked with François BÉDOS DE CELLES. He was active during the reigns of Louis XV and XVI (1747–83), and worked almost exclusively in the Languedoc-Roussillon region, with a few contracts in Riom, Bordeaux, Toulouse, and Cahors; from 1760 he was based around Pézenas. His most notable organs were at Pézenas, St. John (1755–58; case survives), Paris, St. Roch (case survives), Lodève Cathedral (rest.), and Montpellier Cathedral (collab. Isnard). He carried out extensive repair work at Clermont-Ferrand (Cathedral), as well as Boulbonne, Narbonne, Nonnenque, and Saint Papoul. During a period of financial crisis in the 1780s, he took over his father-in-law's cloth and silk trade, and left his organ contracts to Jean-Pierre Cavaillé (in particular St. Guilhem-le-Désert), never imagining that the latter's grandson, Aristide CAVAILLÉ-COLL, would completely rebuild L'Epine's Pézenas organ and so many others.

Adrien L'Epine (1735–1780), another son of Jean-François L'Epine I, moved to Paris in 1758; he probably worked with Joseph ISNARD and definitely married the sister of François-Henri CLIQUOT. Having worked on the organ of Nantes Cathedral (1767), L'Epine built one for the Benedictine Abbey of Saint-Avit-les-Chateaudun that same year. In 1768 he worked on the instrument at Nogent-sur-Seine, then built an organ for the Royal Military School (1772), and worked on the Brie-Comte-Robert organ (1773). In 1778, he improved the wind-supply at Paris, St. Médard, and built a new organ for Montargis. Also a harpsichord builder, he presented a "piano-forte organisé" (a combined piano-organ, or CLAVIORGAN) to the Academy of Science in 1772.

JEAN-RENAUD ANSART
CHRISTOPHER HAINSWORTH

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LESLIE

SEE ELECTRONIC ORGAN

LÉTOURNEAU, FERNAND (WILFRED JOSEPH) (B. 1944)

Canadian builder, founder of Orgues Létourneau Ltée/Létourneau Pipe Organs Ltd. in 1979. Létourneau served as head voicer at CASAVANT FRÈRES (1964–78), working alongside Lawrence I. PHELPS and Gerhard BRUNZEMA. After a Canada Council for the Arts grant allowed him to take a yearlong tour of European organs, Létourneau returned to Quebec and began building his own instruments, establishing his firm in Ste. Rosalie, then St. Hyacinthe (1984). The firm, very much a family endeavor, has built nearly one hundred instruments, mostly with mechanical action, and in many cases a choice of flexible or steady winding. Orgues Létourneau has installed three-manual instruments at St. John's, Newfoundland, St. Andrew's Presbyterian (thirty-seven stops); Grand Rapids, Michigan, Trinity Lutheran (thirty-six stops); Kalamazoo, Michigan, First Baptist (fifty-four stops; and Washington, D.C., Church of the Ascension and St. Agnes (fifty-five stops). Four-manual instruments include Trois-Rivières, QC, Cathedral of the Assumption (seventy stops); Edmonton, Alberta, Winspear Centre for Music (ninety-six stops); and Sydney, St. Andrew's Anglican Cathedral (fifty-eight stops). There are also instruments in Austria, England (London, Tower of London, 2/30), and New Zealand. The firm is also active in rebuilding and reconstructive work.

RICHARD KASSEL

LEWIS, T(HOMAS) C(HRISTOPHER) (1833–1915)

English organbuilder. Trained as an architect, Lewis formed an organ-building business with two partners, John Tunstall and John Whitaker, around 1860. In 1866 Lewis moved into a new factory at Ferndale Road, Brixton, London. During 1877 he built a large four-manual concert organ for Glasgow, New Public Halls (later St. Andrew's Halls). Lewis built and rebuilt organs, and branched out into bellfounding. By 1884 he was operating as Lewis and Company, Ltd. Its largest organ, intended as a memorial to Robert Courage, father of managing director John Michel Courage, was built in 1896–97 for St. Saviour's Collegiate (now Southwark Cathedral), London.

By about 1900 T. C. Lewis had left the firm, which continued to trade as Lewis and Company, Ltd.; it maintained the same high standards, as seen in the instrument at Glasgow, Kelvingrove Art Gallery and Museum (1901–02; 3/48; rest. Mander, 1989). A merger took place in 1919 with Henry WILLIS and Son, which moved into the Ferndale Road works, becoming Henry Willis and Son and Lewis and Company until 1925, when the Lewis name was dropped. T. C. Lewis continued in organ building for some time after leaving the company he founded. His work combined the best qualities of the German and French tonal palette (his string and flute stops are exquisite) with a robust and exciting diapason chorus. The standard of craftsmanship in the voicing and finishing of a Lewis organ is such that, a century later, the sounds continue to charm and exhilarate the listener.

JOHN POWER

LEWIS AND HITCHCOCK

American organ-building firm. The company was founded in Washington, D.C., in 1915 by William I.

Hitchcock (1875–1967) and Theodore C. Lewis (1895–1973); they had met in Washington while working for Ernest M. SKINNER. Early instruments were built with membrane electro-pneumatic action; after 1919 the firm switched to pitman electro-pneumatic action. The action, construction, console, and tonal style were very similar to those of the Skinner firm. Following World War II the style changed to unit electro-pneumatic action, and the tonal style changed to American classic.

Early factory locations were in the southeast and northwest sectors of the district; in 1962 the firm moved to Silver Spring, Maryland. In 1967, the firm was purchased by George Payne (b. 1935). The action was changed to direct-electric, the tonal style to modified American classic. Other firms were merged into the business, including the Lent Organ Service of Philadelphia (1986) and the Roggman Organ Service of Waynesboro, Virginia (1987).

The firm's first mechanical action instrument was built in 1970. In 1983, the firm was acquired by Edward Newcomer (d. 1973) and Harold Newcomer (d. 1989); it operated under the name Newcomer Organ Company until the latter's death. Since that time, the original name has been restored; the current president is Gerald L. Piercey. The firm has its main office and factory in Beltsville, Maryland, with a branch in Richmond, Virginia. Lewis and Hitchcock organs have been installed at College Park, Maryland, St. Andrew's Episcopal (1991); Richmond, Three Chopt Presbyterian (1990); Hinton, West Virginia, First Presbyterian; Mars Hill, North Carolina, Broyhill Chapel, Mars Hill College (1989); and Portales, New Mexico, Buchanan Recital Hall, Eastern New Mexico University.

RICHARD KASSEL

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LIEBLICHGEDECKT

A stop (Ger., "sweetly stopped") known since the time of Michael PRAETORIUS (around 1600); its tone is quiet, smooth, and bright. The Lieblichgedeckt has been made of both wood and metal, and authorities disagree on which is preferable. This stop is characterized by a very high cut-up, sometimes even greater than the width of the mouth. The Lieblichgedeckt was popularized in the nineteenth century by WALCKER and SCHULZE. Schulze introduced it to England in his 1851 Exhibition organ where, according to Wedgwood, it "caused a sensation" and was "quickly raised to perfection" by Willis and Lewis. As introduced by Schulze it was of stopped metal, having unflatted, arched upper lips. Willis made it with pierced stoppers, like a Rohrflöte.

See also **Stop**

EDWARD L. STAUFF

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LINGUAL

Another name for the REED stop, referring to the SHALLOT and beating (striking) tongue assembly that produces sound for these stops.

LINK ORGELBAU

Organ-building firm located in Giengen, Germany. The twin brothers Paul Link (1821–1891) and Johann Link (1821–1871) trained in organ building with Anton Braun of Spaichingen (1836–40) and then worked for ten years with E. F. WALCKER; here they became familiar with a large number of technical reforms, including the development of the cone-valve chest. In 1851 they started up their own business in Giengen an der Brenz. They soon built a larger workshop, which remains the Link worksite in the early twenty-first century. By 1884 they had completed and delivered one hundred organs. In 1886 the next generation, Christian Link (1854–1926), and Eugen Link (1855–1940), took over the leadership of the firm and increased the export of organs to Europe, Asia, and South America.

In the third generation, Eugen's sons Reinhold Link (1888–1946), and Werner Link (1904–1986), carried on, and in the fourth generation Reinhold's son-in-law Friedrich Schmid (b. 1910) ran the firm, which prospered in the postwar economic "miracle." In 1988 Christoph Naacke (b. 1955) bought the firm. Naacke, the great-grandson of the founder of the Bier pipemaking firm (also in Giengen), studied with Link, worked with Tschöckel and Bier, and undertook a lengthy learning visit to the United States. He worked for six years in the Link workshop before taking over the leadership. In 2003, Raimar Galter (b. 1966) took over operations of the company. He had studied at Binder in Romania and came in Link in 1993. Galter runs the firm under the name Giengener Orgelmanufaktur Gebr. Link.

Besides building new organs, the firm specializes in the restoration of stop-channel organs. Some Link organs include: Giengen, 1906 (rest.; 3/51); Heidelberg, 1986 (3/41); Trier-Ehrang, 1994 (2/34); and Frankenthal, 2001 (3/41).

CHRISTOPH KEGGENHOFF

LIP

In a FLUE pipe, the upper and lower edges of the MOUTH opening. The lower LIP provides the front of the WINDWAY and helps direct a "flat sheet" of wind to the upper lip. The upper lip deflects the sheet of air into eddies on both sides of itself, producing a set of edge tones; the frequency of one of these is voiced to "match" the length of the pipe involved. That pipe, therefore, is the final determinant of the pitch first generated by the lips.
See also **Languid**

LITHUANIA

Lithuania became Christian in 1386, the last European country to do so. The first recorded organ was a portative given to Ona, Duchess of Lithuania, by the Grand Master of the Teutonic Order, Ulrich von Jungingen. Source material about organs in Lithuania is sparse and incomplete, the region having endured much warfare and conflagration. A few names of sixteenth-century organbuilders have survived. In 1510, Herman Zelyg (Selig) of Cracow built a positive for Vilnius Cathedral; by 1525, there was a larger organ on the loft. The cathedral received a new and larger organ (1595–97), built by Johann Koppelmann; he assisted Julius Anthoni Friese in building of the main organ at Danzig (now Gdansk, Poland), St. Mary's, which he finished after Friese's death (1506). A fire destroyed Koppelmann's Vilnius instrument in 1610; its specification remains unknown. During this time, St. John's Jesuit Church and the Bernardine monastery church in Vilnius had organs. The Jesuits in Nemezis, near Radziwill (Radvila), had an organ by 1586; a new instrument was built (1611–15). In 1630, Georg Otta of Lemberg (Lvov, Poland), was commissioned to construct an "opus organicum." Another Vilnius organbuilder was Andreas Grolnig (d. 1652).

Fires that devastated Lithuanian towns left few traces of Lithuanian organs of the sixteenth and seventeenth centuries; the dates of surviving pipes and fragments have proven difficult to determine. Vilnius, center of organ building, burned down completely at the beginning of the eighteenth century. Between 1735 and 1785, skilled masters such as Josef Olszowski, Adam Gottlob CASPARINI from Königsberg (Kaliningrad, Russia), Nikolaus Janson, Gerhard Arend Zelle (student of Georg Sigismund Caspari), and Friedrich Zelle (Szel) worked in Vilnius. They built organs of various sizes in the newly constructed, grandiose churches of the capital. Eleven Baroque organ FACADES date from this period. The oldest surviving Baroque organ in Lithuania was built by Casparini at the Dominican Church of the Holy Spirit (1776; 2/31). Some of its stops are noteworthy: a Flaut Travers 8', half-stopped with a conical head piece,—in other words, a Koppelflöte (rare for the period); a Jula 8', little known in the literature, here a very narrow, open, wooden flute; the Pedal Füllbass à 12' (10-2/3'); and a carillon (Vox Campanarum, i.e., Glockenspiel) in the organ facade, consisting of twenty-four semicircular small cup-bells and played on the second manual. Other significant two-manual organs, built during the second half of the eighteenth century, were rebuilt near the turn of the twentieth century. In towns like Linkuva, Kurtuvenai, Troskunai, and Tytuvenai, facades of great artistic value have been preserved. Several single-manual organs of similar construction bear witness to a notable school of organ building in Lithuania.

Other organs have connections to Casparini. A relatively large instrument remains in the former monastic church in Tytuvenai. While its builder and year of construction are unknown, all features suggest its builder to be Casparini (it also has a Glockenspiel). The Tytuvenai church was fully restored in 1788, and the organ was probably also built at that time. Since Casparini died that year, this organ could have been his last work, finished by his most important pupil, Christoph Wilhelm Braveleit. Like other Lithuanian organs of the period, it has two manuals but no pedalboard. In the mid-nineteenth century, there was a similar instrument at Vilnius, St. George, rebuilt by Waclaw Biernacki at the beginning of the twentieth century. Some of its remaining stops suggest that Casparini or one of his pupils built this organ as well. Finally, the Casparini organ built for Polock (now Polatsk, Belarus), Jesuit Church and transported to the St. John's University Church (1834; orig. 1/23). Theodor Tiedemann enlarged the organ to forty-one stops on three manuals and a pedal. Around the turn of the century the instrument was rebuilt by Juozapas Radavicius (1857–1911). After World War II it was plundered, and now awaits restoration.

Outside of Vilnius, virtually all surviving organs (approximately sixty) from the eighteenth and the early nineteenth centuries have one manual and around ten stops—typically, a Principal 4' in the facade, a stopped 8', a Jula 4' (less often 8' and 2'), a Quinte 2-2/3', an Octave 2', a Mixture repeating in each octave, the Glockenspiel, and a Timpano consisting of two deep pipes. The compass of the keyboard ranged from C to c''' or f'''; the short octave was rare, and the tuning one to three semitones higher than modern standards. The builders' names are unknown; the years of construction can only be deduced from the style, architecture, wood carvings, year of the church's construction of the church, and the like. Such criteria are often unreliable, such as the continuing use of Baroque wood carving and older principles of specification and intonation into the nineteenth century. There were, of course, larger organs with a Principal 8' basis. Only a few positives remain in existence.

Due to the familiar tendency toward modernization, many old organs no longer exist. New organs were built into old cases, or the smaller Baroque organs were replaced by larger Romantic instruments, especially in the wealthier parishes. The most important representatives of the Lithuanian Romantic organ-building school were Radavicius, Jonas Garalevicius (1871–1943), and Martynas Masalskis (1858–1954). In 1882, Radavicius built the organ in Kaunas (Kowno) Cathedral, the largest in Lithuania, with slider-chests and tracker action (3/62); the key and stop actions include BARKER LEVERS. Radavicius built a smaller three-manual instrument for Vabalninkas; in other areas of Lithuania, dozens of one- or two-manual organs built by him are present. Radavicius's organs all have slider-chests with mechanical tracker action.

Garalevicius was associated with Barnim Grüneberg in Stettin, where he worked for fifteen years. He set up his workshop in Kaunas and built almost exclusively slider-chest instruments of one or two manuals. He was the first Lithuanian builder to try combining mechanical key action and pneumatic stop action. In the fifteen years before World War I, Garalevicius built about a hundred organs, not only in Lithuania, but also in Latvia, Poland, Russia, Siberia, and the Ukraine.

Masalskis, an autodidact, invented a stop-channel chest that was inexpensive and easy to build, but his organs had heavy actions, were hard to regulate, and gave less than ideal speech from the pipes. Masalskis built approximately sixty organs in Lithuania. Although his instruments are not remarkable, some are classified as historical monuments to protect the work of this master who left a deep imprint in Lithuania's organ building.

Other late Romantic builders were F. Weissenborn (Jacobstadt, Latvia; twenty tracker slider-chest organs) and C. Hermann and Son (Libava, Latvia). There are a few organs by world-renowned firms such as E. F. WALCKER, RIEGER, and LADEGAST. There were also many anonymous instruments dating from this period. Romantic instruments were generally rather small and rarely had more than twenty stops. Mechanical cone-valve chests are seldom found.

The first pneumatic organs appeared in Lithuania to great enthusiasm. Still extant is the highly praised instrument in Leliunai by Bruno Goebel of Königsberg, successor to Max TERLETZKI (1910; 2/21). It contains many octave couplers and fixed and free combinations; it has been classified as a historical monument. Other pneumatic organs were built by Biernacki (Vilnius); Emil Martin (Riga), and Otto Kratochwil (Siauliai).

Lithuania's incorporation into the Soviet Union signaled a dark period for its organ culture. Organ building was interrupted; with the closing of many churches, organs were robbed and destroyed. (Fortunately, no particularly valuable organs were lost.) The craft of organ building was increasingly neglected and the maintenance, tuning, and restoration of instruments were often carried out in a injurious manner. Attempts to build new organs were hindered by a lack of necessary building materials and technical knowledge.

At the beginning of the 1960s, the organ recital culture was revived, and organ playing was once more studied at the Academy of Music, Vilnius. In music school concert halls and in former churches now housing museums, new organs were built and old ones restored. New instruments were constructed by VEB Potsdamer SCHUKE-Orgelbau and by Rieger-Kloss. The protection of organs as historical monuments was established, and a state-owned workshop for organ restoration was founded in 1972. For many decades the maintenance and rebuilding of organs had been of a poor quality; these instruments await a thorough and qualified restoration, but funds are often unavailable.

According to the latest results of an organ inventory initiated in the late 1960s, approximately two-thirds of the remaining churches (ca. 660 in number) have organs—that is, there are approximately 440 organs in the country. One hundred and fifteen organs built between 1700 and 1850 are classified as historical monuments, a number that will only increase as more current and broad-reaching surveys are performed.

RIMANTAS GUCAS
JAN JANCA

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LITURGY

The public, corporate worship of God, usually in reference to the Christian Church. The word derives from the union of two Greek words, λαιτος, "of the people," and εργον, "work." Early Christians used the term in general for all prayer and sacrifice, but it most frequently denoted a community rather than a private act. The term continued to be used in the Eastern church (for the celebration of the Eucharist, the equivalent of the Roman Catholic Mass), but dropped out of Western church vocabulary until the sixteenth century, when it reappeared in the writings of early humanists. *Liturgy* now referred to the entire complex of services, both weekly (Mass) and daily (Offices); from its use in titles of books delineating the worship of the Roman Catholic worship, it came to have a similar meaning to the word *ritual*. The widespread influence of the twentieth-century liturgical movement has largely restored the word to its original meaning.

The relationship of the organ to Christian liturgy remains problematic. It is not known how the organ gained entry into the church, given the early church's opposition to the use of instruments in worship. It may have represented an embodiment of cosmic harmony and a means of teaching basic neoplatonic doctrines associated with the quadrivium and the medieval cosmic worldview; in any case, the organ's entrance into the church had little or no liturgical basis. There are reports of organs in churches well before the tenth century, but documents do not link the instrument to the celebration of the liturgy before the twelfth century at the earliest, and its use therein did not become commonplace until the Renaissance.

The gradual incorporation of organ music into liturgical celebrations seems to parallel the rise in prominence of polyphony. As the organ's mechanical improvements kept pace with the demands placed on it by musical developments, the church organ became capable of performing contrapuntal music. By the thirteenth century most major churches in Europe, both monastic and lay, possessed an organ; by the fifteenth century many of them had a larger one for solo performance and a smaller one to accompany or support choral singing. The famous lines from Geoffrey Chaucer's "Nun's Priest's Tale"—"His voys was murier than the murie orgon / On masse-dayes [i.e., feast days] that in the chirche gon"—confirm what other sources show: that the organ was originally played only on festival days, and never during the penitential seasons of Advent and Lent.

The earliest preserved organ music is largely in the form of ALTERNATIM settings, from the fourteenth century on: versets for the ordinary of the Mass, organ hymns and sequences, and settings of psalms and canticles (notably the Magnificat), all intended to be sung in alternation with choral verses, either chant or (later) polyphony. Pope Clement VIII's *Caeremoniale episcoporum* (Rome, 1600) states that the organ is played alternatim for the Kyrie and Gloria, the Sanctus and the Agnus Dei; the organ is also played solo at other times, including the Offertory, the Elevation of the Host, and the end of the Mass. This repertory was largely improvised over a cantus firmus; what remains of it, though extensive, represents only the tiniest fraction of the activity and vitality in these genres. Alternatim organ performance persisted in Roman Catholic worship before being formally banned in Pope Pius X's *Motu proprio* of 1903. In France and elsewhere, the use of the organ persisted in the celebration of the "Low Mass," spoken by the priest while the organist played (or improvised) almost continuously; this practice died out in the wake of the Second Vatican Council.

Throughout the Middle Ages the organ had its detractors, so the attitudes of sixteenth-century reformers toward the instrument cannot be considered novel. John Calvin and Ulrich Zwingli banned organs from worship outright, and the English Commonwealth's widespread destruction of organs may be understood as a later extension of Calvin's influence. Martin Luther was mildly opposed to the use of the organ, tolerating it only because of his innate love of music; he did appreciate the talents of gifted organists. Alternatim performance, now extended to Lutheran chorales, flourished in Lutheran circles throughout the sixteenth century.

The use of the organ to accompany congregational singing, beginning in Protestant Germany in the early years of the seventeenth century, brought an era of renewed vitality to the instrument. The practice gradually became widespread enough so that, by the end of the nineteenth century, few Protestant churches were insisting on unaccompanied congregational singing. A standard instrument for figured bass accompaniment during the seventeenth and eighteenth centuries, the organ in the nineteenth century assumed a new role as the primary accompaniment to choral and solo church music. This holds true especially in England and the United States, where many anthems have been written with elaborate, orchestrally inspired organ accompaniments. A concern for suitable stops for choral accompaniment played (and continues to play) a major role in the determination of many organ stoplists.

The growth of organ performance as a prelude and postlude to the liturgy is more difficult to document. The practice is assuredly very old. Particularly in continental European cathedrals, the large organ (typically over the western portal) had no actual liturgical function until the nineteenth century, but was played on festival days to accompany the entrance and exit of the bishop. Organists in the United States commonly perform organ compositions preceding and following worship services, while European organists frequently improvise for the entrance and exit of clergy and choir, especially in Catholic Masses.

The dawn of the twentieth century saw the organ enthroned as the sacred instrument par excellence, its sound being considered the epitome of "churchliness." The start of the twentieth-first century sees a much more varied musical liturgical practice. Though the notion that the organ is the most proper instrument for the church is still strong in many quarters, the rise of alternate styles of worship that deemphasize or exclude the organ, while featuring the use of other instruments at the same time, underscores the weakening of the bonds that have until recently bound the organ to the church. *See also* **Organ Mass**

Quentin Faulkner

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LLENO

See Plenum

LOBO, HEITOR (CA. 1495–CA. 1567)

Portuguese organbuilder. Of his known works, the most significant was a large organ at the convent at Vilar de Frades, Barcelos/Braga, 1551. A posthumous rebuilding contract (1592) indicates that the instrument had two manuals, pedal (16'), and 30 stops (after dividing the manuals), and was artistically refined; the anonymous rebuilder kept thirty-five Lobo pipes. The instrument was further renovated during the eighteenth century, but ruined during a restoration of the chapel in 1941. Other identified works include two organs for the Porto cathedral (1537–8), probably replaced in the eighteenth century by the present Baroque instruments. In 1541, Lobo apparently rebuilt an organ at the Coimbra, Santa Cruz, monastery (first built 1530–32) and returned to repair it in 1558, 1551, and 1567. There are records of further renovations in 1610 and 1615. While Évora's cathedral organ may have been built as early as 1544 there is little doubt that Lobo built the extant instrument (ca. 1560), judged on stylistic (Catholic Renaissance) grounds. It is one of only a few surviving sixteenth-century Portuguese organs. The cathedral owned an identical case to this one (perhaps for an unfinished instrument), lost ca. 1940. Lobo also built organs for Viseu, monastery of Santa Cruz de Coimbra, (ca. 1559, reb. ca. 1583) and Guimarães, Colegiada of N. Senhora da Oliveira (1562).

Richard Kassel

LONG COMPASS

The standard compass in English and Anglo-American keyboards from the late seventeenth through the early nineteenth centuries, which descended to GGG (= modern GG) except in the smallest chamber organs; also known as long octaves. Continental organs, like modern ones, usually had keyboards extending down to CC (= C; etc.) with a short octave in the bass until the eighteenth century. In rare instances the long compass descended a whole step lower, to FFF; the GGG# (or FFF#) was usually missing. This unique compass may have been meant to compensate for the lack of pedal keys in most English organs before the early nineteenth century, or possibly due to the influence of the harpsichord. Another possibility is that it was somehow connected with the conversion from the old 12' "C" (modern g) to the newer 8' "C" (c') during the Restoration. Growing Continental influence brought an end to the practice in England during the 1830s and '40s, although long compass organs continued to be built in some parts of the United States, notably the Boston area, until 1850. Organ voluntaries whose compass descends below CC are not uncommon in the literature of the eighteenth and early nineteenth centuries; on modern instruments the notes below CC can usually be played on the pedal.

Barbara Owen

LORENTZ, JOHAN (CA. 1580–1650)

German organbuilder. Born in Grimma, Saxony, Lorentz was apprenticed to Nicolaus Maass in Stralsund, later becoming his chief journeyman. When Maass set up as an organbuilder in Copenhagen around 1602, Lorentz probably followed him, but in 1604 Lorentz and his brother Balthasar were sent to work on the large organ at Flensburg (Schleswig), St. Nicholas. In about 1609 he settled as an independent organbuilder in Flensburg, becoming a licensed master in 1610. After the death of Maass in 1615, Lorentz was given the task of completing Maass's unfinished work in the Frederiksborg Castle chapel. This marked the beginning of thirty-two years' service as court organbuilder.

Facades by Lorentz may be seen in Elsinore, St. Mary's, (ca. 1634), the chapel of Kronborg Castle (1639), Nakskov (1648), and Kristianstad, Sweden, Trinity Church (ca. 1631; facade pipes preserved). The organ in Elsinore is of special interest, because Dietrich Buxtehude was organist there (1660–68). In modern times two attempts at reconstruction inside the original facade, first in 1960 and again (more successfully) in 1998 (by Marcussen & Son).

The remaining traces of Lorentz's work give the impression that his instruments were more lyrical than imposing in effect. He may have been influenced by the mannerist style of Maass; his instruments seem appropriate to the expressive and kaleidoscopic chorale fantasies of the early Baroque.

Ole Olesen

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LOW COUNTRIES

Through the Fifteenth Century

The earliest mention of organ building in the Low Countries (referred to as "Netherlandish" until the creation of the modern Belgium and Netherlands) is found in the Utrecht Psalter, written shortly after 850 ce in the Benedictine Abbey of Hautevillers, in northern France. This organ apparently had no ecclesiastical function, but may have been used as a signal organ. Another organ, probably used in church, is mentioned around 1100, in the abbey of Lobbes (southern Belgium); no further details are known. An anonymous fourteenth-century painting (Musees Royaux des Beaux Arts, Brussels) showing scenes from the life of the Virgin depicts a positive. This instrument does not seem to have any means for the selection of stops, and the number of keys cannot be determined. The *Agneau Mystique* (Lamb of God) by Jan van Eyck in Ghent Cathedral (1432) shows a positive with short and large keys, played with the fingers. The arrangement of the pipes poses several problems; there was clearly no short octave, however. The tuning could well have been that advocated by Arnolt Schlick.

There were Netherlandish organbuilders already operating during the fourteenth century in the southern Netherlands. They were followed by churches in the north: Ghiselbert Talp built an organ in 1404 in Utrecht with (probably) a *Rugpositief* (Rückpositiv). Among the builders working in the southern Netherlands were Daniel van der Distelen and Hans Suisse (Suys, Süss), both from Antwerp. In the northern Netherlands, builders included the van Elen family (Maastricht, fl. 1423–1480), Adriaan Pieterszoon (Delft, d. 1480), Livinus Zwits "of Cologne" (ca. 1440–70), the Gerritszoon family (Utrecht, ca. 1470–1635), Jacob Bilsteyn (Kampen, d. before 1480), and the Lampeler family (fifteenth and sixteenth centuries).

Early in the sixteenth century, Brabantine organbuilders (working in the former duchy of Brabant, not the current provinces of Brabant, Belgium, or Noord Brabant, Netherlands) started building organs with a slider-chest, by which ranks of pipes could be played independently by means of a slider. This new technology was rather difficult to build, so it was applied at first only to the Rugpositief and (where present) the *Borstwerk* (Brustwerk). The *Blokwerk* (Blockwerk) remained sliderless, since sliders were blamed for loss of wind pressure.

The usual Netherlandish organ, then, consisted of a Great (*Grotewerk*; later *Hoofdwerk*), a Rugpositief, and a Pedal (Pedaal). The Hoofdwerk division was an undivided five- to ten-rank Mixture (*Sterkwerk*) based on the Blokwerk, composed of open Principal 4' and stopped Gedeckt 4' pipes; the division was sometimes known as a *Doevenwerk* (*Doeff* = Principal). The Rugpositief could be divided into two small windchests, one supporting a Mixture (often separate), the other with Flutes or Holpijp (*Fluitwerk*). The Pedaal was at this time a series of pull-downs to the Blokwerk in the keyboard. Two ways of arranging display pipes were used: the first, called *ad modum mitre episcoplis* ("like a bishop's miter"), placed the tallest pipe in the middle; the other (in Arnault de Zwolle's expression, *ciste communis*), placed the tallest pipe on one side, then descended to the shortest pipe on the other.

In larger organs, however, builders started to divide the Blokwerk into independent sections. Bigger organs grew more refined: a third keyboard became necessary (for the Borstwerk), and the Pedaal grew in importance as well. The number of pipes increased, no longer connected to the Blokwerk, but to the Rugpositief and the Borstwerk. Pedaal keys could also be connected to more than one chest (what Williams calls "multiple action"). Here is the disposition for the (unbuilt) Antwerp Cathedral organ by Daniel van der Distelen (1505):

HOOFDWERK			
Principaal	8	II (one open, one closed rank)	
Oktav	4		
Fluit	4		
Mixtuur			
Scherp			
RUGPOSITIEF		BORSTPOSITIEF	
Principaal	4	Scherp	
Fluit	4	Trompet	8
Mixtuur		Cromhoorn	8
Scherp			
Zink	8		
Regaal	4		

RUGPOSITIEF PEDAL		BORSTPOSITIEF PEDAL	
Boerdon	8	Boerdon	8
Fluit	4	Mixtuur	(4)
		Scherp	

Stylistic Growth, Increasing Reputation: Sixteenth Century

During the sixteenth and seventeenth centuries, the art of Netherlandish organ building became very influential, according to Michael Praetorius (*Syntagma musicum* II, 1619). The center where this great art developed was mainly around 's-Hertogenbosch in the north, and Antwerp and Louvain in the south, the Brabantine region.

In the north, new stops appeared, imported by Rhinelandish builders such as Jan van Covelens. Van Covelens introduced a major innovation to the organ at Utrecht, St. Mary's (1525): a Bovenwerk with two Positiefs within the same case. This feature had been introduced to him by his pupil and later partner, Hendrik Niehoff, who would develop it further. Niehoff was valued to the extent that the authorities of 's-Hertogenbosch, St. Jansker, even sent him, at their expense, to Maastricht and Liège to study southern Netherlandish organ building and new pipe forms. After van Covelens's death, Niehoff partnered successively with Hans Suisse, Jasper Johannsen, and his own son Nikolaus Niehoff, who succeeded him. His greatest significance may have been his support of the change from slider- to spring-chests.

By the 1580s, the division between northern and southern styles was well-established. In the southern Netherlands, organs were slightly smaller; the Rugpositief (although originating here) was not obligatory. The Pedaal was less developed. A few stops can be considered as typically southern: the Cornet (four to six ranks) and Flauto Traverso (one or two ranks); builders avoided typically northern stops as the Baarpijp and the Zink 8'. Since the Cornet was extremely popular in the south, it became planted directly behind the front of the Great organ. From there, it was given a small independent chest, thus becoming the Flemish forerunner of the French *Récit*. The conservative approach to organ construction can be summarized by the fact that slider-chests were still preferred in Flanders.

Apart from the Brabantine builders, other southern schools contributed significantly: the Verryt family (Lier, sixteenth century), the Moors family (Antwerp, first half of the sixteenth century), the Brebos family (Antwerp, latter half of the sixteenth century), the Langhedul family (Ypres, ca. 1475–ca. 1638), and builders such as Charles Blancart in Ghent, Crespin Carlier in Lille, and Jean Crinon in Mons. Several southern organbuilders left Flanders: the Brebos family went to work at the Escorial, Hans Brebus went to Denmark, Carlier went to Toulouse, and Matthys Langhedul settled in Paris. Indeed, the notion of a "Brabantine school" should be applied to these expatriate builders and to instruments built in the Rhineland (Hans Suisse, Graurock family), Westphalia (Rodensteen family), and southern Germany and Austria.

The northern Netherlandish school opted for rich and clear stops such as the Tertscymbel and Zink, more frequent use of the Rugpositief, and a well-developed Pedaal in towers. A very large chest in which the *organo pleno* flutes and reeds were placed was also favored. In Zwolle and Kampen the so-called eastern Dutch school centered around the Slegel family (ca. 1540–ca. 1680). In Arnhem, the Morlet family (ca. 1550–1700) built organs for both the north and the Rhineland. Although Peter de Swart (d. 1599) and Jan Roose (d. 1600) both worked in Utrecht and knew the Niehoff spring-chest, they tended to use the older type of slider-chest; de Swart still built the Grotewerk as an undivided Blokwerk.

Further north, in present-day Frisia and Groningen, the most famous organ-building dynasties were those of the de Mare family (Groningen, 1540–1740) and Rodensteen (Bolsward, sixteenth century). Here spring- as well as slider- chests were made. One larger organ that used both was built by Andreas de Are at Groningen, Notre Dame (1558; 3/39). As often happened in this period, its Rugpositief was very rich in stops (same number as the Grotewerk—eleven—including a Quintadena 16') in order to match the other divisions. Also noteworthy was the highly developed Pedaal: Principaal 16', Oktaaf 8', Oktaaf 4', Mixtuur VI–IX, Trompet 16', Bazuin 8', Kinderbas 2', Ranket 1'.

The Netherlandish Golden Age

The two hundred years beginning in the middle of the sixteenth century proved to be a golden age for organbuilders in the Low Countries. Never again did their fame become so great, nor were their instruments ever again in as much demand throughout Europe. Although the organ received more attention in the north, it certainly was not due to support from the religious authorities: the Protestant synods of Holland and Zeeland (1574) as well as the Assembly of Middlelburg (1581) banished organs completely from the service, in favor of the human voice. On the other hand, the organ became increasingly a symbol of municipal wealth for the civil authorities who propagated organ concerts.

As a result, large organs evolved in Kampen, Leiden, Utrecht, and Zwolle.

After the Iconoclasts destroyed several instruments in the southern Netherlands, the Counter-Reformation started with the construction of the organ in the Ghent Cathedral (1592), followed by the court chapel in Brussels (1594, 1601–8). The centers of organ building from then onward were Bruges, Ghent, and Ypres in the Flemish region, and Brussels, Liège, and Nivelles in the French (Wallon) region of modern Belgium. The last craftsman to build organs in Renaissance style was Matthys Langhedul. After his death, the firms of Lanoy, Le Royer, Marquet, and others developed the Baroque organ: a curved front with a central tower and four fields of pipes. In the south, organs were placed in rather small cases with a curved facade, central tower, and four pipechests, without pedal towers. Some organ cases inspired by the Belgium model were present in the north, but their organ specifications remained Dutch.

During the seventeenth century, the north featured builders such as the van HAGERBEER family. A particularity of the northern organ was the double Principal pipes, soldered together at the feet but blown through the same conductor (an element already present in a 1466 Haarlem organ). By the end of the seventeenth century the organ was once again in use to accompany the congregation; solo playing continued as well. Both Hoofdwerk and Pedaal divisions developed in versatility.

In Groningen and Uithuizen, the Hamburger Arp SCHNITGER brought German characteristics into the Dutch organ: dispositions including as a different Principal scaling, more brilliant mixtures, and rather narrow Roerfluiten, and the 24' pedal tower. Schnitger had many followers in the north (as witnessed by the organs at Zwolle, Grote Kerke; Alkmaar, St. Laurens; and churches in Ootmarsum and Ruinerwolde), and his sons continued his work, notably Franz Caspar SCHNITGER, who contracted for the famous St. Laurens organ in Alkmaar (1723–26).

Other external influences reached the North; furthermore, a new ideal combined refined sonority with sheer power. Christian MÜLLER from the German Harz region pursued this new trend in the organ of Haarlem, St. Bavo's (1735–38), as well as Amsterdam, Waalse Kerk, where he rebuilt the 1680 Nicolaas Langlez organ. The Flemish builder Jacob François MOREAU added some French sonorities to Gouda, St. Jan, with its southern-style case and wide-scaled reed pipes reminiscent of the French organ. Slowly the Rugpositief was disappearing in Holland. Meanwhile organ building became more and more decadent, both in regard to specifications and cases.

The southern Netherlandish organbuilder who best synthesized French and Flemish style is Johannes Baptista Forceville of Brussels (ca. 1660–1739). He developed two organ types: the first one placed a Positief in the center, and, to the left and right against pillars, the great organ and pedal in large cases. This type was proposed for Brussels, St. Michel Cathedral (1706–14; lost). The second type, still standing in St. Carolus Borromeus, Antwerp, splits the Great organ with the Positief as the divider. In both types, Forceville eliminated the Rugpositief. His organs had a wide facade and added Récit and Echo keyboards. Flemish cases in this period were very rich and ornate; Wallonian organ cases were generally less so.

The most important pupil of Forceville was Pieter van PETEGHEM. He provided a well-furnished Great organ, but continued to use pull-down pedals (except at Aalst and Lebbeke). The chests remained small, and the wind pressure low. These organs were designed for many different colors and shades, rather than the ensemble choruses of the past. The DELHAYE family also contributed significantly to eighteenth-century south Netherlandish organ building.

Romanticism and Beyond

The Romantic organ was taking shape. French influence, especially from Aristide CAVAILLÉ-COLL, became more significant. Noteworthy among the characteristics of this instrument were greater size, "darker" stops such as the Gamba, completely new stops such as the Unda Maris and the Flûte Harmonique, the disappearance of the Scherp and other mixtures; and the emergence of neogothic and other retrospective cases.

Belgian builders had difficulty keeping up with organ building abroad. When François-Joseph Fétis published his *Rapport sur l'Etat actual de la facture d'orgue en Belgique compareé à sa situation en Allemagne, en France et en Angleterre* (1850), criticizing Belgian organ building, it provoked the better Belgian builders such as Hippolyte Loret (1810–1879) to challenge Fétis's conclusions. But Fétis was essentially right: the work of most other builders was below the standard found abroad. Taking advantage of the situation and with the support of Fétis, a German organbuilder, Joseph MERKLIN had established himself in Brussels in 1843. In his organ at Liège, St. Barthelemy, Merklin introduced combination pedals and the *clavier expressif*. Pierre Schijven (b. 1827), an apprentice of Merklin's, built heavily Romantic organs of good quality (Brussels, Notre Dame du Sablon). Other nineteenth-century Belgian organbuilders included the Anneessens and the Kerkhoff families. Twentieth-century builders include Patrick Collon (Brussels), George Delmotte (Tournai), Jos Loncke (Dixmude-

Esen), Bernard Pels (Herselt), Stéphane Schumacher (Eupen), Aerts and Jos Steven (both Duffel), and Alois Thunus (Malmédy).

Among the firms active in the Netherlands during the nineteenth century (some lasting into the next century) were ADEMA, Zwier van Dijk from Kampen (Genemuiden, Nederduits Hervormde Kerk, 1873), KNIPSCHEER, JAN van Loo in Zwolle (Dedemsvaart, Nederduits Hervormde Kerk, 1868), VAN OECKELEN, and SMITS. The Maarschalkerweerd firm of Utrecht built the organ at Oene (1852). Dutch organbuilders of the twentieth century have included Bakker and Timmenga, van de Berg and Wendt, D. A. FLENTROP, van den Heuvel, Kamp and Zoon, and Vierdag.

See also **Division; Ems-Dollart Region; Windchest**

FERDINAND J. DE HEN

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LOWE, JOHN (CA. 1760–1813)

American organbuilder, born in England. Lowe trained in the London shop of Robert Gray (d. 1796); by April 1798 he had immigrated to Philadelphia. During his career, he built several of the country's largest organs, including instruments for Philadelphia, Zion German Lutheran (1809–11), Philadelphia, St. Paul's Episcopal (1808–12), and New York, St. John's Chapel (1812–13). Lowe's final commission, for Philadelphia, St. Peter's Episcopal, was completed by his protégé and apprentice, Thomas S. HALL.

Lowe's name has perpetuated because of one particular event: his 1813 organ for New York's St. John's Chapel was captured on route by the British seventy-four-gun *H.M.S. Plantaqenet* during the War of 1812. It was released after the payment of a hefty ransom; but the resulting stress was said to have led to Lowe's death in New York on 13 December 1813.

Lowe organs were reputedly the finest instruments built in America during the first decade of the nineteenth century. His art was carried on by Hall, who became one of the most significant New York organbuilders of the next generation, and would later go into partnership with Henry Erben.

STEPHEN L. PINEL

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LOWREY

American maker of electronic organs. The company, founded by Frederick C. Lowrey, began developing an electronic instrument by purchasing, in 1918, the rights to the Choralcelo, in which electric generators supplied power to electromagnets, causing piano strings to vibrate (a process not unrelated to electro-pneumatic organ ACTION, then in vogue). After experimenting with several different systems, Lowrey brought out the Organo (1949), a small ELECTRONIC ORGAN operated from a piano-type keyboard. Lowrey's first organs used twelve oscillators, one for each semitone; in the 1970s, this was superseded by a single very high frequency (VHF) master oscillator, made possible by transistors (1964) and integrated circuits. The majority of Lowrey organs had two forty-four-note manuals, staggered by an octave. In 1956, an upward semitone slide was introduced; in 1961 a model was introduced with a built-in Leslie speaker (later replaced with an electronic equivalent). The company's innovations have included automated features: rhythm tracks (1968), bass lines, accompaniment (1970), and imitations of string and other orchestral sounds, culminating in the 1976 "Orchestral Synthesizer" (the late-nineteenth-century organ in miniature). Microprocessing was introduced in 1980; results included automatic harmonization of single notes and Lowrey's version of the Vox Humana. The company was bought by Norlin Industries, La Grange Park, Illinois, in 1975.

RICHARD KASSEL

LUND, CARSTEN (B. 1940)

Danish organbuilder. Born on 12 May 1940, he completed his training in 1961 at the Frederiksborg Organ Factory and was later employed there. From 1962 to 1966 he worked for Poul-Gerhard ANDERSEN; it was during this period that his interest in the history of organ building, the national types of organ, and the growth of modern organ design based on northern European traditions was awakened and developed. In 1966 Lund founded his own firm in Copenhagen. He was one of the first in Denmark to experiment with classical building methods: unequal temperaments, flexible winding from wedge bellows, smooth-running, suspended key action, hammered pipe metal, and so on. His early instruments were received with enthusiasm by many organ players, pleased by the expressive, saturated tone colors, the supreme craftsmanship, and the refined key action, but the instruments also aroused skepticism from those who preferred a more moderate tonal design. Copenhagen organs from this period are Husum Church (1977) and Tagensbo Church (1979).

During the following years Lund pushed his initial, Arp SCHNITGER–influenced organ style in a more southern European direction, inspired by luscious Italian Principales and powerful Spanish reeds. The results could be heard at Copenhagen, St. Stephen's (1983), and Esbjerg, Hjerting Church (1994). In his mature years Lund has met the market demand for versatile, more eclectic organs, fusing Baroque and Romantic elements, such as the instruments at Oslo, Vålerengen Church (1987) and Copenhagen, Sion's Church (1996). Lund has not focused on producing strictly neobaroque and similar instruments, but he agreed to reconstruct the Baroque organ in Garrison Church, Copenhagen (1995), considered one of his most successful works.

Lund, a noted organ designer, has built cases ranging from modernist approaches with stringent and resilient curves to more embellished facades with historical style elements. Any stylistic divergences are bound up with the architectural surroundings of the site.

OLE OLESEN

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M

MAARSCHALKERWEERD

Dutch family of organbuilders active from the mid-nineteenth to the early twentieth centuries. Pieter Maarschalkerweerd (1812–82) learned organ building as an apprentice of Jonathan BÄTZ. In 1840, Maarschalkerweerd established his own workshop in Utrecht with Christiaan Stulting (1803–81). The Stulting and Maarschalkerweerd partnership built a few small instruments in the classical Dutch tradition of Bätz before Stulting left in 1848. Maarschalkerweerd continued to build organs under his own name until his son Michael Maarschalkerweerd (1838–1915) joined the business, leading to the formation of Maarschalkerweerd en Zoon in 1865.

A majority of the firm's organs went to Catholic churches in the Netherlands. Maarschalkerweerd en Zoon's work can be divided into three periods. The first, up to the early 1880s, was characterized by mechanical action instruments in traditional Dutch style. French influences, specifically those of Aristide CAVAILLÉ-COLL, predominate in the second period (from the elder Maarschalkerweerd's death to 1895): detached consoles, BARKER LEVERS, combination pedals, second manuals under expression, harmonic flutes, and voicing of foundation and reed stops. Examples from this era include the firm's largest instrument in the Amsterdam Concertgebouw (1891; 3/46; reconstr. Flentrop, 1993) and church organs at Sneek, St. Martinus (1891; 2/27; rest. Flentrop, 1995–97) and Delft, St. Jozef (now Maria van Jessekerk; 1893; 3/38). With his organ at Zwolle, Onze Lieve Vrouwekerk (1896), Michael Maarschalkerweerd turned to German models for inspiration; he used membrane-chests and a pneumatic action using the Weigle system. Although new chest types and actions were used during this third period, the same high quality of construction and voicing prevailed as before.

While there are definite French and German influences, the younger Maarschalkerweerd's organs are not imitations but reflect a personal approach to organ building. Maarschalkerweerd also maintained numerous historic organs, among them the famous Müller instrument in Haarlem, St. Bavo's (rest. 1905). His work on these organs was generally conservative and respected much of the historic substance of the original. Maarschalkerweerd also wrote a short book, *Over orgels* (1907), and two pamphlets: *Technische beschrijving van het orgel in de St. Bavo te Haarlem* (1907) and *Onderhoud, revisie en stemming van het orgel* (1911).

JAMES L. WALLMANN

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MAASS, NICOLAUS (D. 1615)

Organbuilder active in Denmark and Germany. The name Maass (Maas, Maess) suggests a Dutch extraction, but it is not known where he was born or who his parents were. In 1592 he became a naturalized citizen of Stralsund, and during the following years he was active in Vorpommern. His most famous instrument from this period probably was the organ in Stralsund, St. Nicholas (1599). Important work was also done in Stralsund, St. Mary's (1594) and in Barth, Colberg, Gollnow, Greifenberg, Grimma, Prenzlau, and Wolgast.

His first organ for Christian IV, King of Denmark, was a positive (1601). By 1603 Maass had settled in Copenhagen and was named "organmaker to His Majesty the King," successor to Hans BREBUS. His most important accomplishments thereafter were the magnificent organ in Flensburg, St. Nicholas, in then Danish Schleswig (1609; reb. Schnitger, 1708; 3/38) and the chapel organ in the newly built Frederiksborg Castle north of Copenhagen (1616; 2/28). Maass died while working on this instrument, and it was completed by his former chief journeyman Johan LORENTZ. The Maass-Lorentz organ at Frederiksborg was destroyed by fire in 1859; the present facade is a beautifully made reconstruction.

The music-loving Christian IV established a royal collection of instruments, possibly inspired by his brother-in-law, Duke Heinrich Julius of Braunschweig-Wolfenbüttel. It is probable that the duke helped connect Maass with Denmark. One of the royal collection's showpieces was the silver organ, a richly embellished positive, built in the style of a luxurious art cabinet; the functioning parts were built by Maass.

None of the Maass organs has survived, but in Flensburg, St. Nicholas, the impressive Renaissance facade, by the wood carver Hinrich Ringerinck, still stands.

OLE OLESEN

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MACHADO E CERVEIRA, ANTÓNIO (XAVIER)

SEE CERVEIRA, ANTÓNIO (XAVIER) MACHADO E

MACHINE STOP

One of the early MECHANICAL AIDS, dating from the eighteenth century; also called a shifting movement. A foot lever operated directly on the end of a slider; upon depressing the lever, the corresponding stops were taken off, although their drawstops remained open. The lever's release triggered a spring to return the slider to the sounding position. One of the first mechanical aids to be developed since the COUPLER (fifteenth century), the device was frequently used in English CHAMBER ORGANS, specifically to suppress higher-register stops (e.g., Principal 2') to produce a quieter timbre for echo or other soft passages without having to lift the hands off the manuals. The organ machine stop was conceptually related to a similarly named harpsichord device that added and subtracted registers in an ultimately unsuccessful attempt to compete with the new fortepiano's dynamic flexibility. By the next century, however, organbuilders were turning to swell shades to generate changes in loudness and eventually invented other devices to permit registral changes "in flight."

See also **Composition Pedal; Pedal Check**

RICHARD KASSEL

MAHLER, RÉMY (B. 1956)

Alsatian organbuilder. Mahler was trained by Muhleisen in Strasbourg and worked there for six years; in 1985 he started his own business, moving it to a larger workshop in Pfaffenhoffen (1987). Beside several restorations in the Alsace area, Mahler has built numerous new organs in France and Germany, ranging from small instruments up to three-manual church organs.

Tonally, the organs show two principal trends: the Alsatian-French school, with organs in Eschbach (1990; 2/15), Ungersheim (1991; 2/26), and the organ-building school in Eschau (2000; 2/14) in France; and Landau/Palatinate, St. Elisabeth (1997; 2/21) in Germany. The South German school influenced the instruments in Bretten (1994; 1/13) and Kirrweiler (1998; 2/24) in Germany, and St. Etienne de Baigorry (1999; 2/22) and Suippes (2001; 2/28) in France.

A typical characteristic of Mahler's style is a strong reflection of organ-building technologies from the seventeenth and eighteenth centuries. Mahler was the first builder since Aristide CAVAILLÉ-COLL in 1899 to exhibit a large organ at the Paris organ fair. He is the first organbuilder to be decorated by the French Secretary of Education and Cultural Affairs with the Chevalier des Arts et des Lettres in 2000.

CHRISTOPH KEGGENHOFF

MANDER

English organ-building family. Noel Percy Mander (b. 1911) worked for the Rest Cartwright firm (from 1929 on) and worked occasionally for Henry Speechly and Sons before founding N. P. Mander Ltd., London (1936). The firm's initial reputation came for its restoration work on organs damaged during World War II. Mander was made a Member of the Order of the British Empire in 1978 in recognition of his achievements for over fifty years. He retired in 1983, his crowning achievement having been the reconstruction of the 1872 Willis organ in St. Paul's Cathedral, London (1977; 5/132), which set new standards for the rebuilding of large Romantic organs. His son John Pike Mander (b. 1949) joined the firm as a partner in 1975, after a five-year apprenticeship with Rudolf von BECKERATH in Hamburg. He returned to Germany in 1980 to complete the master's examination, then became head of the Mander firm upon his father's retirement.

The Mander firm makes new organs, most with tracker action, as well as portatives, positives, and regals. Modern techniques, including computer-assisted design, are regularly used, but most mechanical parts are of wood. The firm casts pipe metal and makes its own pipes, using 75 percent tin for Principals but high lead content for Flutes.

New Mander organs in England include Cambridge, Corpus Christi Chapel (1967; 3/51) and St. John's College, Cambridge (1984; 4/81); and Essex, Chelmsford Cathedral (1997; 4/78). U.S. installations include Westminster College in Fulton, Missouri (1969; 2/39); Pittsford, New York, Christ Church (1991; 2/33); New York, St. Ignatius Loyola (1993; 4/91); Alexandria, Virginia, Immanuel Church on the Hill (1994; 2/15); Detroit, Christ Church Cranbrook (1997; 4/110); New York, St. Agnes (1998; 2/41); Philadelphia, Chestnut Hill Presbyterian (2000; 3/45); St. Louis, St. Peter's (2001; 3/53); and Atlanta, Peachtree United Methodist (2002; 4/90). Installations have also been made in Africa, Japan, Norway, and Oman. The company received the Queen's Award for Enterprise in International Trade for 2002.

Important restorations include the 1861 Hill at Belfast, Ulster Hall (1978; 4/98); the re-creation of an eighteenth-century organ from remaining fragments, one of the first of its kind (Cambridge, Pembroke College, 1979; 2/33); the 1886 Willis at Canterbury Cathedral (1980; 3/80); the 1871 Willis in London's Royal Albert Hall (2004; 4/111); and, in the United States, the 1927 Skinner/1951 Aeolian-Skinner at the Princeton University Chapel in Princeton, New Jersey (1991, 4/141).

ARTHUR LAWRENCE

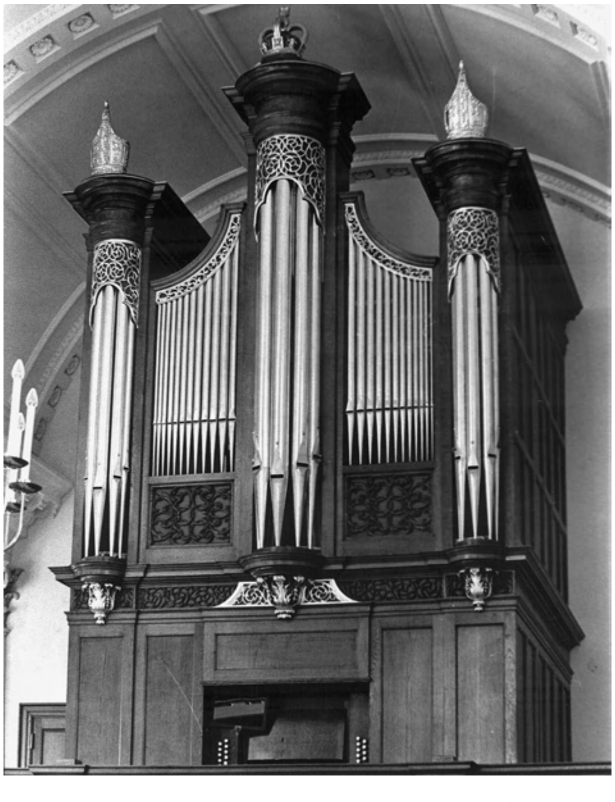

Fig. 54. Mander organ, installed 2003 (2/39), Winston Churchill Memorial and Library, St. Mary Aldermanbury, Fulton, Missouri (originally London, Church of All Hallows the Great).

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MANUAL

SEE KEYBOARD

MANUALITER

A quasi-Latinism (from *manualis*, "hand keyboard") in use by the time of Arnolt SCHLICK's *Spiegel der Orgelmacher und Organisten* (1511), *manualiter* refers to an organ composition performed on the manual(s) without pedals. However, Samuel Scheidt, in his *Tabulatura nova* (1624), suggested that manualiterorgan chorales might be performed with their respective chorales played in the pedals; this approach is now often applied to Johann Sebastian Bach's nine manualiter organ chorales. In addition, the term may have been used to indicate which part of the tablature or score were meant for the manuals, with the term PEDALITER indicating the part to be played by the feet.

There are, however, a number of pieces written clearly for manuals only. In regions where pedals didn't exist (e.g., England before the eighteenth century), there was a great deal of music written for the organ (or for any available keyboard). Baroque composers of manuliter music include Matthias Weckmann, Anthoni van Noordt, Dietrich Buxtehude, and Johann Pachelbel (partitas with alternating manuliter sections). English composers wrote "voluntaries" for trumpet and manualiter in great quantities. Later exponents included Johann Ludwig Krebs, Charles Avison (solo concertos), J. C. H. Rinck, Johann G. Töpfer, Charles-Valentin Alkan, and in the twentieth century, Jan Koetsier, Flor Peeters, and Hugo Distler (*Three Sacred Songs for Soprano and Manualiter*; *30 Spielstücke*).

Richard Kassel

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MARCUSSEN (AND SON)

Danish organ-building firm. Marcussen and Son have produced over one thousand organs installed throughout the world. Their organs were most influential in the years of the Danish version of the *Orgelbewegung*.

The founder of the firm was Jürgen Marcussen (1781–1860), who built his first organ for the Tønder Seminary in 1806. Andreas Reuter (1798–1848), Marcussen's apprentice from 1821 on, became his partner to form the firm Marcussen and Reuter in 1826. In 1830 they moved their workshop to Åbenrå, a few miles from their original site; the factory has remained there to the present day. Together they installed thirty-eight organs, mostly throughout Scandinavia, although two organs were sent in 1847 to St. Croix and St. Thomas in the Virgin Islands. Having completed the restoration of the Nicolaus Maass organ in the chapel of Frederiksborg Castle at Hillerød, Denmark, Marcussen and Reuter was awarded the title Organbuilders to the Royal Court of Denmark in 1836.

The organs from this period were classically tonal in orientation, with increasing emphasis on 8' voices. Two new technical advances were produced by this firm: a box-bellows (*Kastenbalg*), invented by Marcussen in 1818, and the tuning slot (*Stimmschlitzen*), invented by Reuter in 1833; both innovations found their way into organ building in general. After Reuter's death, Jürgen Marcussen joined with his son Jürgen Andreas Marcussen (1816–1900) to establish Marcussen & Son (1848). Two highlights during Jürgen Andreas Marcussen's tenure were the reconstruction of the organ in Lund Cathedral, Sweden (1868; sixty stops), and the restoration (1890) of the famous Arp Schnitger organ in St. Jacobi, Hamburg. Since Jürgen Andreas's only son, Hartvig, predeceased his father, the firm passed to a nephew, Johannes Lassen Zachariassen (1864–1922), who had trained in the family business. Following the trends of the times, and assisted by tubular-pneumatic action, the organs of this period became highly romanticized.

In 1922, Johannes Lassen Zachariassen died; his son, Sybrand Zachariassen (1900–1960), assumed leadership of the firm, which had grown into an extensive business following World War I. By this time the Organ Reform Movement had begun in Germany. Sybrand Zachariassen was among the first in Scandinavia to recognize its principles and to put them into practice. He abandoned the Romanticism of the recent past and brought back historic sounds to the organ. The reconstruction and enlargement of the organ in Copenhagen, Holmens Church (1924), had clearer upper work than had been used previously; Marcussen would continue in this new tonal direction.

In 1929 Marcussen & Son built its first organ with a Rückpositiv, and in 1930 its first purely mechanical slider-chest organ for Copenhagen, St. Nicolai (forty-four stops). A classic Werkprinzip organ—Hauptwerk, Rückpositiv, Brustwerk, and Pedal—was built for St. Catherine, Ribe, Denmark (1932). The organ in Kertreminde, Denmark (1938), had each division housed in its own separate case. Tracker action superseded pneumatic action, and over the next twelve years the slider-chest was used exclusively in Marcussen instruments. Among its more important organs from this period: Skanninge, Sweden (1939; thirty-four stops); Sorø, Denmark (1942; thirty-five stops); Malmø, Sweden (1951; seventy-six stops); Varde, Denmark (1953; thirty-three stops); and the Holmen and Trinitatis Churches in Copenhagen (1956; both fifty stops).

Toward the end of his life, Sybrand Zachariassen built some of his most famous organs for the Grote Kerk, Rotterdam (1959; transept organ; thirty-one stops), Mariakyrkan, Helsingborg (Halsingborg), Sweden (1959; forty-nine stops), and Storkyrkan, Stockholm (1960; fifty-three stops). Sybrand Zachariassen died in October 1960; for a generation he had been one of the leading figures in North European organ building. Management of the firm passed to his engineer son, Sybrand Jürgen Zachariassen, a great-great-grandchild of the founder. A new generation of voicers continued the work on the basis of the traditions of the firm. It was at this time that the restoration of the organ in the Grote Kerk in Haarlem, Netherlands, was completed.

Continued development of sound and technical mastery brought about large organs that combined purely tracker action with a highly responsive touch, as seen in the instruments for the Grudtvigskirken in Copenhagen (1965; fifty-five stops), Linz Cathedral (1968; seventy stops), Lübeck (1970; forty-seven stops) and the Grote Kerk, Rotterdam (1973; eighty-five stops). Marcussen's work at Amsterdam, Nieuwe Kerk (1981), considered one of its era's most important historical restoration projects, rebuilt the largest extant organ with springchests.

Recent years have seen a considerable increase in exports of organs from Marcussen, including Tokyo, Musashino-shi Concert Hall (1984; forty-one stops), Fukushima, Japan, Concert Hall (1985; forty-two stops), Wichita State University, Wichita, Kansas (1986; sixty-three stops), Fort Collins, Colorado, First United Methodist (1987; forty-four stops), and Jerusalem, Brigham Young University (1988; thirty-nine stops).

Marcussen is noted for its extensive use of rosewood shallots in all types of reed pipes. Since wood is not so greatly affected by temperature, these pipes remain in tune under greater climatic changes than those made with metal shallots.

ROBERT CAVARRA

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MARIMBA

A percussion stop usually found on theater organs, consisting of wooden bars suspended over resonators (like the orchestral prototype) and struck by an electric or pneumatic mechanism. It often has a reiterating action, played from the same physical stop as the single-stroke Harp.

See also **Stop**

EDWARD L. STAUFF

MARKLOVE, JOHN G(ALE) (1827–1891)

English-born American organbuilder. Born in Berkeley, Gloucestershire, on 12 March 1827, Marklove was a boy chorister, and was educated at Oxford University. He apprenticed with GRAY AND DAVISON in London, and operated his own business in Cheltenham, England. He immigrated to the United States (ca. 1852), stopping first in New York, where he was employed by Henry ERBEN. In 1854, he moved to Utica, New York, where he became the shop foreman for Alvinza ANDREWS. He opened his own shop in Utica in 1858, and built organs there, despite a ruinous manufactory fire in 1866, until his death in Scarboro Beach, Maine, on 21 August 1891. He was succeeded by his son Clifford F. Marklove, A. E. Barnes, and Clarence Morey.

Marklove organs had a wide geographical distribution, with customers located as far away as Red Bank, New Jersey; St. Paul, Minnesota; and Indianapolis. His largest instruments, all three-manual, were built for Calvary Episcopal , Christ Dutch Reformed (1883), and Trinity Episcopal, all in Utica. and St. John's in Montgomery, Alabama. Marklove organs were characterized by sturdy construction and simple but elegant casework. The best-preserved Marklove organ, built in 1867, is located at St. Mark's Episcopal in Candor, New York.

STEPHEN L. PINEL

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MASON AND HAMLIN

American organ- and piano-building firm. Mason and Hamlin's history is firmly interwoven with the history of music in the United States. It was established in Boston by Henry Mason (1831–1890) and Emmons Hamlin (1821–1885). Hamlin had discovered a method of voicing free reeds while working for George A. PRINCE. Henry's father, Lowell Mason (1792–1872), composer and an early advocate for public school music in the United States, suggested to his son that he form a business with Hamlin to produce reed organs. Mason and music publisher Oliver Ditson (1811–1888) each supplied $5,000 toward the undertaking, and the firm was born in 1854.

Hamlin's method of free-reed voicing revolutionized the reed organ industry. He had found that by imparting a curvature or bend to the reed tongue, the quality of tone would be smoother and more pipe organ–like than on earlier instruments. The first instruments with the Hamlin reed had flat-topped low cases and the name "Organ Harmonium," first sold in July

1855 and patented in May 1856. In 1861 the name became the "Cabinet Organ," as distinguished from the melodeon. The company was located in Boston (until 1888), then in Cambridgeport, Massachusetts, and finally in New York. The firm produced about 450 organs per year from 1855 to 1861; as early as 1867, when Mason and Hamlin was awarded first prize for its instruments at the Paris Exposition, the company was producing about one-quarter of the reed organs made in the United States. The company was very innovative, introducing, besides voiced reeds and low case, the double-exhauster bellows and the knee swell. In 1883, the production of pianos was introduced; like the organs, they were of the highest quality.

A catalog from 1880 displays some eighteen models of organs, from a folding instrument of four octaves and one set of reeds to one of two manuals, pedal, and twenty-three stops. (For an illustration of a Mason and Hamlin organ, see REED ORGAN.) The company also produced the "Liszt Organ," which employed oversized reeds. Sometime after 1884, James BAILLIE-HAMILTON approached Mason and Hamlin, hoping the firm would manufacture his Vocalion organ, but without success. In 1904, a similar arrangement was broached by the French harmonium maker Mustel, but it, too, came to nothing. Henry Mason's son, Edward P. Mason (b. Cambridge, MA, 1859) became president of the company upon his father's death in 1890. Another son, Henry Lowell Mason (b. 1864) entered the firm in 1888 and became its president in 1906. (By this time, Mason and Hamlin had built 229,269 organs.) The firm produced a few pipe organs around the turn of the century.

In 1911 the piano business was sold to the Cable Piano Company of Chicago and the organ portion of the firm was acquired by the ÆOLIAN COMPANY. The piano division was eventually acquired by the Æolian Corporation and exists today as the title component of the Mason and Hamlin Companies of Haverhill, Massachusetts, makers of Mason and Hamlin, Sohmer, and Falcone pianos.

JAMES HOWARD RICHARDS

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MASS

SEE ORGAN MASS

MATHIS

Swiss organ-building firm. Located in Näfels, the firm was founded in 1960 by Manfred Mathis. At first, Mathis built organs with electric actions and freestanding (uncased) pipes, but then the company began to incorporate time-honored traditions such as mechanical action, freestanding cases, logical division placement, and appropriate (lower) wind pressures.

Under the leadership of Hermann Mathis (since 1992), the firm has been expanded so that, with the exception of electrical components, all organ parts, including the case and pipes, could be built in-house. The operation is designed so that the entire building process can be monitored and controlled for quality; the firm works together on one organ at a time, thereby assuring that each instrument is unique. Solid woods taken from one of the largest reserves among European organbuilders are used, along with leather and raw metals. Visual and tonal matters are of particular importance, with facades and cases designed to be complementary to a particular location, and voicing that aims to achieve a sonorous, overtone-rich, voicelike tone quality that, without being harsh or shrill, can produce colorful registrations over a broad dynamic range.

As of 2002 Mathis Orgelbau has built over 350 new instruments (church, house, and concert organs) and restored a number of valuable historic organs from different eras. Many recordings for radio, television, and CD have given the firm's work international recognition. Among its instruments are: St. Gallen, Cathedral, choir organ (rest. 1968; 2/32); Näfels, St. Hilarius (1980; 3/39); Neu St. Johann, (rest. 1990; 1/16); Einsiedeln, Mauritius organ (1994; 4/62), and Basel, Cathedral (2003; 4/78), all in Switzerland; Vienna, Schotten Monastery (1995; 3/49); Görlitz, Germany, St. Peter and Paul (1997; 3/64); Munich, St. Anna im Lehel (1999; 2/23); Fiecht, Austria, St. Georgenberg (2000; 2/31); Rome, Sistine Chapel (2002; 2/15); and Tokyo, Aoyama Gakuin University (2002; 3/39).

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Translated by Douglas E. Bush

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MAURACHER

Austrian organ-building family. The prolific Mauracher family actually consisted of two lines, the Fügen and the Zeller, both originating around 1720 in the Ziller Valley, Tirol; their relationship is not clear. The proliferation of workshops in different cities, as well as the repetition of first names and errors in the literature, have made tracing their activities awkward. All of their work was built for Austrian clients.

The founder of the Fügen line was Andreas Mauracher (b. Kapfing, 8 Feb 1758; d. 9 Nov 1824), builder of around forty instruments. His son Karl Mauracher (b. Kapfing, Fügen, 24 Oct 1789; d. there, 24 May 1844), is known to have repaired the organ in Arnsdorf in 1821 and installed a new organ at Oberndorf, St. Nikolaus, in 1825. In addition to some fifty organs, he built pianos. While working in Oberndorf, he obtained a copy of the composition of *Silent Night* and took it home with him. Thus the tradition began that Franz Gruber's carol was a "Tirolean folk song."

Johann Nepomuk Carl Mauracher (b. Kapfing, 26 July 1818; d. Salzburg-Seekirchen, 20 Nov 1884), son of Karl Mauracher, moved the workshop twice, to Branau am Inn (1845) and Salzburg (1861). Although he created a stir at an 1854 industrial exposition in Munich by using zinc facade pipes, his generally conservative approach made him seem old-fashioned in later life. He built around sixty instruments. 4. Ludwig Mauracher (b. Kapfing, 24 Aug 1820; d. Feldkirch, 11 Apr 1885), another son of Karl Mauracher, did not work in any Mauracher workshop; instead, he worked for Johann Haller, Gebr. Mayer, SCHULZE, , and E. F. WALCKER.

Albert Mauracher (b. Branau am Inn, 12 Mar 1858; d. Salzburg, 2 July 1917), son of Johann Nepomuk Carl Mauracher, maintained his father's workshop for a short time after his death, but opened a new workshop in Salzburg-Mülln in 1886. Albert was up-to-date and innovative in his work, turning to cone-chests, pneumatics, and, from 1899 on, his own system, the "Aerofunctionslade." He also developed a small instrument, the Cölesticon (two to six stops), that could be separated into two pieces and easily transported. In 1908 he was briefly associated with Matthäus II (Zeller line; see below). Active throughout Austria, Albert built over 120 organs. Upon his death, the firm was taken over by Adam Grünsfelder (1861–1934), but he sold it to Franz Mauracher (Zeller line; see below) in 1920.

The Zeller line of the family was started by Matthias Mauracher I (b. Oberbichl, 24 Nov 1788; d. Graz, 22 Nov 1857); he was active in Zell am Ziller, Tirol, and built about thirty organs. He was succeeded by his son Matthäus I (Mathias II) Mauracher (b. Zell am Ziller, 20 July 1818; d. Salzburg, 7 Aug 1884), who moved the firm from Zell am Ziller to Salzburg-Parsch in 1861, on the advice of Peter Singer, an organist and composer who obtained organ-building commissions for Mauracher in the monasteries of Admont, St. Florian (restoration) and Kremsmünster. Matthäus I first employed a type of STOP-CHANNEL chest (*Hängeventillade*) in 1870, invented by his son Josef Mauracher (b. Zell am Ziller, 2 Feb 1845; d. St. Florian, 5 Feb 1907) and perfected by 1878; it was found mostly on Austrian organs. Matthäus I was very active, with over 120 instruments to his credit. Many of his organs have been restored and designated historical monuments. Among the more important are the organs at the Salzburg Kollegienkirche (1866–68; 3/34) and Mauterndorf (1870; 2/15).

After Matthäus I's death, the dynasty was continued by Josef Mauracher, Hans (Johann) Mauracher I (b. Zell am Ziller, 29 Mar 1847; d. Salzburg, 12 June 1900), and Matthäus Mauracher II (b. Zell am Ziller, 26 Nov 1859; d. Salzburg, 25 Jan 1939), sons of Matthäus I, who took over their father's firm. In 1891, a second branch was founded in Graz; Matthäus II took over the new facility, while Hans I became the sole proprietor of the Salzburg-Parsch branch. In the meantime, Josef Mauracher had started his own workshop in St. Florian in 1880; thus the firm could call itself Matthäus Mauracher's Söhne, Salzburg—St. Florian—Graz from 1891 on.

After Hans I's early death, his son (Karl) Franz Mauracher (b. Salzburg, 17 Nov 1881; d. there, 27 Aug 1949) took over the Salzburg-Parsch branch. His inexperience soon led to insolvency, and his uncle Matthäus II took over in 1907. (In 1908, Matthäus II was briefly associated with Albert Mauracher of the Fügen line; see above.) Franz worked in various firms in Germany, returning after World War I to work for Matthäus II. In 1920 he bought out Albert's firm from the latter's successor, Adam Grünsfelder. However, both his and Matthäus II's firms became part of Cäcilia, Österreichische Orgelbau AG, an "institute for artistic organ building" founded in 1922 by Vinzenz Goller. Franz served as technical director until 1926; Cäcilia reorganized two years later. Johann (Hans III) Mauracher (b. Salzburg, 12 Aug 1907; d. there, 22 Mar 1970), Franz's son, attempted to revive the original firm's tradition, but was not successful.

Shortly after Josef's death, his sons Matthäus Mauracher III (b. St. Florian, 20 Sept 1885; d. Linz, 23 Aug 1954) and Anton Mauracher (b. St. Florian, 24 Nov 1896; d. Linz, 12 Oct 1962) took over the St. Florian branch. Their firm (now Gebr. Mauracher) was moved to Linz in 1926. Inactive as were all Austrian organbuilders during World War II, Gebr. Mauracher never recovered from the economic drought. One of its largest organs, Wien, Pfarrkirche Neumargareten (1955; 3/52), was its last; it closed at the end of that year.

After Hans's death, Matthäus II continued the Salzburg branch. He endeared himself to the Salzburg faithful by restoring the mechanical organ (*Hornwerk*) at the Fortress Hohensalzburg (1892). He also built a remarkable instrument for the birthday of Emperor Franz-Joseph; the 1910 "Kaiser-Jubiläums-Orgel" is still in use in Bad Ischl, St. Nikolaus (ren. Mauracher, 1914; now 4/101, electro-pneum.). After his firm was merged into the Cäcilia group, Matthäus II started another firm (1926), but did only small jobs; the early death of his son Matthäus (IV) Mauracher (b. Graz, 5 Dec 1901; d. Salzburg, 22 Jan 1923) had ended any hopes of the continuation of his branch of the dynasty.

From the eighteenth until the twentieth centuries, the four generations of the Mauracher family operated in all Austrian regions and combined traditional craftsmanship with technical improvement. They were one of the country's most significant builders, especially in the nineteenth and early centuries. (For a selective list of their instruments, see Reichling and Reichling).

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MCMANIS, CHARLES (B. 1913)

American organbuilder. Born in Kansas City, Kansas, on 17 March 1913, McManis received A.B. and Mus. B. degrees from the University of Kansas. He completed a five-year apprenticeship with a representative of the AUSTIN ORGAN COMPANY, working during summers and vacation periods. In 1938 he founded the Charles W. McManis Company in his hometown. One of his most important accomplishments involved specialized voicing techniques that used pipe nicking as a determiner of tone production.

A well-respected organbuilder, he helped found the American Institute of Organbuilders (AIO). He officially retired in 1986 and moved to California; but after a tornado in July 1989, he was called out of retirement to rebuild his 1957 organ at St. John's Episcopal, Waterbury, Connecticut (compl. 1991; 3/56); he subsequently served as the organ's curator for ten years. Other organs include: Kansas City, Missouri, Holy Cross Lutheran (1958; 2/8; enl. 1970; 2/29); Brighton, Colorado, Zion Lutheran (1969; 2/17, mechanical action); Denver, Wheatridge United Methodist (1970; 2/22); Bradenton, Florida, Manatee Community College (1973; 3/49); Kansas City, Missouri, All Saints Episcopal (1973; 2/8); Chicago, St. Peter's Episcopal (1982; 2/29); and Denver, University Hills Baptist (1987; 3/42).

DOUGLAS E. BUSH

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MEANTONE TEMPERAMENT

A modern expression that different writers use with quite different meanings. It can refer to any cyclical temperament (i.e., with uniform perfect fifths) in which the major third is significantly smaller than in equal temperament and the whole tone or major second (the difference between a perfect fifth and perfect fourth) is exactly half the size of that major third—that is, is its "mean." Such tunings dominated Western keyboard music from around 1460 to around 1660. Contrarily, some modern writers use this term to refer exclusively to "1/4-comma meantone temperament," a tuning (first described in Zarlino, 1571) in which the major thirds are pure; the fifths are smaller than pure by 1/4 of the syntonic COMMA.

Those who use "meantone temperament" to refer to 1/4-comma meantone temperament are likely to use the term *modified meantone temperament* for any other shade of regular meantone temperament. But some scholars use *modified meantone temperament* when they mean an irregular, late Baroque *temperament ordinaire* or the like (in which the diatonic notes may all adhere to the pattern of a regular meantone temperament, but the chromatic notes are tuned in such a way as to provide a circle of fifths). The best-informed writers use the term *modified meantone temperament* for tunings in which only one or two of the chromatic notes diverge from the regular pattern of a meantone temperament, without providing a circle of fifths.

See also **Tuning and Temperament**

MARK LINDLEY

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MECHANICAL ACTION

SEE ACTION

MECHANICAL AIDS

Devices that allow organists to combine, program, add, or subtract KEYBOARDS, PIPES, or SOUND EFFECTS. The first devices to aid the performer in making changes during performance were descended from mechanisms designed to combine manuals, such as the permanent PULL-DOWN between the PEDALBOARD and the STOPS of the manual. Then COUPLERS between independent pedal and manual DIVISIONS and, more prominently, between two manuals were in place by the fifteenth century, allowing two manuals' stops to be performed on one manual. The most common were the SHOVE or push coupler, involving the pushing in of a lower manual to catch the back end of the upper manual's keys, and the sliding keyboard, in which the upper manual is pushed in, engaging the lower. (The octave coupler involved a more complex adjustment to the instrument's action that made key action heavy and limited its usage.)

From early in the Renaissance, the DRAWSTOP had made opening and closing stops during performance feasible. But organists (even with assistants) had to perform rapid, often acrobatic stop changes in the increasingly complex textures of Baroque music. During this period, a special SLIDER known as a shifting movement or MACHINE STOP allowed the taking off of upper-register stops as a group, then brought them back on when desired. In the eighteenth century, the COMPOSITION PEDAL freed the hands by controlling the bringing on and taking off of a preset group of stops. PEDAL CHECKS, knee levers, and even individual drawstops could be applied to this role.

At the beginning of the Romantic era, the mechanical presetting of a fresh group of stops, creating a new Mixture, benefited substantially from the development of pneumatic and, later, electro-pneumatic and electric motors. Combination actions, as such memory devices became known, were programmed permanently by the builder or allowed the performer to select stops in three ways: (1) a selected piston is put "on" while the desired stops are put on, thereby "capturing" those stops once it is released; (2) stops are selected, then a "set" piston is put on and held while a selected piston is put on; the stops will be "tripped" when the piston is engaged; or (3) a separate set of switches on a "setter board" are put on or off for each programmable piston. In every case, combinations have the potential to expand the range of an instrument's couplings and mixtures greatly. All settings may be checked by "cancel" buttons.

Pistons themselves are of two types: (1) general, that allow access to all the instrument's stops and couplings, and (2) divisional (local), limited to the stops of one division. The distinction allows for even greater variety of sonic contrast. Pistons can take the form of "toe studs" located above the pedalboard (called the "kneeboard") and operated by the feet, or "thumb pistons," placed on "thumb rails" between manuals.

Another development of the nineteenth century is the reversible (piston), which functions as an on-off switch without a toggle; push once, and the combination (usually a division coupling) goes into effect; push again, and the combination is taken off. Two reversibles were more common: the Great to Pedal coupler and the SFORZANDO pedal. Like the piston, the reversible can be located above the pedals or on the thumb rail. The reversible's function is determined by the builder; although the reversible uses a different principle from an on-off switch, both types accomplish binary goals, a prelude to the electrically driven and computerized instruments of the twentieth century.

Other pedal devices found their way into organ technology at the turn of the nineteenth century. The most common was the swell pedal (swell shoe), which opened and closed the shades on those divisions "under expression," able to convey gradual dynamic change. While the concept of cases with movable shades date back to the Baroque era, the perfecting of the swell pedal made this division an essential part of the Romantic organ.

The crescendo pedal (*Walzer*) was another, less popular solution to the quest for pianolike dynamic variety and flexibility. Located to the right of the swell pedal, it was a combination action that could be set by builder or performer; but unlike the piston, the action of the device (a balanced-hinge foot pedal) brought on or took off stops "gradually," in a protodigital manner atypical of its time. The stepwise gradation of dynamic and timbral change was a challenge to be overcome by smooth footwork, from closed position, the softest (heel down, toe up) to open position, the loudest (heel up, toe down). In closed position, only those stops with knobs drawn would sound. The device was never popular with composers, demonstrated by the lack of significant music requiring its use. An alternative to the crescendo pedal, the ROLLSCHWELLER, used a foot-operated rotating drum instead of a pedal; but it was even less successful.

In the first two-thirds of the twentieth century, electricity, electronics, and solid-state systems (transistorization) all but eliminated the mechanical nature of aids for the organist; even the emblematic drawstop became a plastic toggle switch (stop tablet). Whatever the loss of physical connection for the performer, there was for some a compensatory simplification of the console. With the introduction of digitalization, memory "channels" or "levels" now permit overlapping sets of combinations to coexist yet can change places instantly on command; memory banks allow for the storage of almost innumerable combinations, whether the organ is on or off. Sequencers and programmable stages permit greater precision of gradual change.

In addition to the technological miniaturization associated with the postmodern organ, options as practical as pitch transposers (permitting the accompanist to play a piece as written while the singer can choose a comfortable vocal range) and liquid crystal display (LCD) readouts of all aspects of the instrument in preparation for and during performance have come into play. MIDI (musical instrument digital interface) collaboration has broadened compositional perspectives on an instrument often considered outdated, with new possibilities of pitch, timbre, and projection ready for exploration.

Yet, as with so much of postwar culture, there has been a reaction, brewing even before World War II as the ORGAN REFORM MOVEMENT, even as mass production and competition spurred the invention and refining of new technologies. For a time, the "authenticity movement" saw new instruments that could have been built in the Baroque era, with only the most traditional stops and mechanical devices retained. However, with the recent softening of polemical lines, and the need to build or repair very complex or deteriorated instruments, some of the best ideas of the nineteenth century (e.g., pneumatic and electro-pneumatic systems, electric blowers) and twentieth century (sensitivity to acoustic environment, improved building materials, contemporary visual sensibility) have found their way back into the picture.

See also **Action; Electronic Organ; United States, Future of the Pipe Organ in the**

RICHARD KASSEL

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MECHANICAL ORGAN

A general category of automata or other organlike instruments that produce sound, mostly through cylindrical movement, using (1) cylinders with pins, (2) sheets or "books" of perforated cardboard, or (3) rolls of perforated paper to operate pallets or valves in a WINDCHEST. In some cases, water or clock mechanics was the trigger. In the nineteenth century and beyond, human participation was expanded to operating a crank, working a foot pedal, or otherwise setting the system in motion; but by definition human fingers do not play on the manual to produce sounds (indeed, many do not have manuals to play). Some nineteenth-century instruments could switch between manual and mechanical operation ("barrel and finger" organs); there were also devices similar to the "piano player," which could be moved into position to "play" regular organs.

Water Power

The earliest significant automatic instrument was the water organ (also called hydraulic organ), first recorded in the third century BCE. The basic principle differs significantly from the HYDRAULIS, although both use water to regulate WIND PRESSURE. The water organ is conceptually similar to the nineteenth-century WATER MOTOR/ENGINE in that a continuous flow of water sets off a series of steps that eventually produce sound.

The mechanism involved water with regulated gravitational flow that caused a water wheel to rotate. This in turn engaged a gear that motivated a wooden (later metal) cylinder; beneath it was a frame on which a rod (sticker) and pull-down assemblies were set. These were triggered by the presence or absence of wooden (occasionally metal) pegs on the rotating cylinder. (There was one assembly for each potential movement or sound.) The sounding components of the machine were fed upward-moving pressurized air that had entered the same chamber (*camera aeolis*) as the downward-flowing water that served to engage the water wheel.

For the most part, the water organ's interest lay in its automatism and its attempts at the imitation of nature, in both the aural and physical senses. Early examples in the Greco-Roman era, the Byzantine Empire, and the Baghdad-based Abassaid caliphate (tenth century) imitated birdsong and other sounds; the movement of figurines were gradually integrated into the mechanisms. By the late medieval era, water organs had reached Italy; they then spread to other European countries, documented in England by the sixteenth century. Of no interest to the church and beyond the means of any but the wealthiest ruling and patrician classes, water organs combined sound and motion elaborately, with figurines often simulating the playing of instruments in mythological scenes. Water organs were built into ornate cases and were placed in outdoor settings (grottoes or garden, notably Rome's Quirinale Gardens by Luca Blasi) or inside the owner's palace or mansion (see Nöring).

By the end of the seventeenth century, however, lack of interest and the expense involved in maintenance (especially considering the cost of military expenditure by European monarchies defending their rule) led to the demise of the water organ.

Cylindrical Mechanisms

During the many centuries that water-powered automatons were in vogue, the mechanism itself—rotating pinned cylinder—served as the basis for another kind of instrument, the barrel (drum) organ. These instruments contained a cylinder that generated musical sound as soon as a hand-operated crank geared to it was rotated; related instruments are mentioned in Greco-Roman as well as Arabic sources (usually some form of automatic hydraulis). Its most spectacular appearance may have been the instrument given by an English trading company to Ottoman Sultan Mehmet III (1599), with the approval of Queen Elizabeth I (and the crucial participation of Thomas Dallam). An extremely elaborate mechanical organ such as this embodied the idea of including "all the bells and whistles," especially percussion, in an instrument normally associated with church services and sacred music. Even more "miraculous" was the movement of the keys on automata with a standard keyboard (but with no live performer), being played by an "invisible" rotating cylinder sitting parallel to that keyboard.

By the eighteenth century, makers had incorporated an important technical innovation; when the organ's crank was rotated, it operated not only the cylinder that set the tunes but also the bellows that winded the instrument. This made barrel organ players totally independent, whether the instruments they played were (1) used in smaller churches as substitutes for trained organists and genuine organs, (2) chamber organs performing the popular repertoire of the day, or (3) street organs. By the eighteenth century, the barrel organ was widely known in the highly portable form (misnamed the hurdy-gurdy) used by itinerant "organ grinders," and in a more substantial form transported on a cart. The smaller barrel organ originated in Italian puppet theaters, later spread throughout Europe, and finally arrived in England, where they became associated with Italian street musicians and the requisite "trained" monkey. (The French organ grinder preferred to work with dogs such as the bichon.) Italian builders in England continued to make these instruments; but once immi-

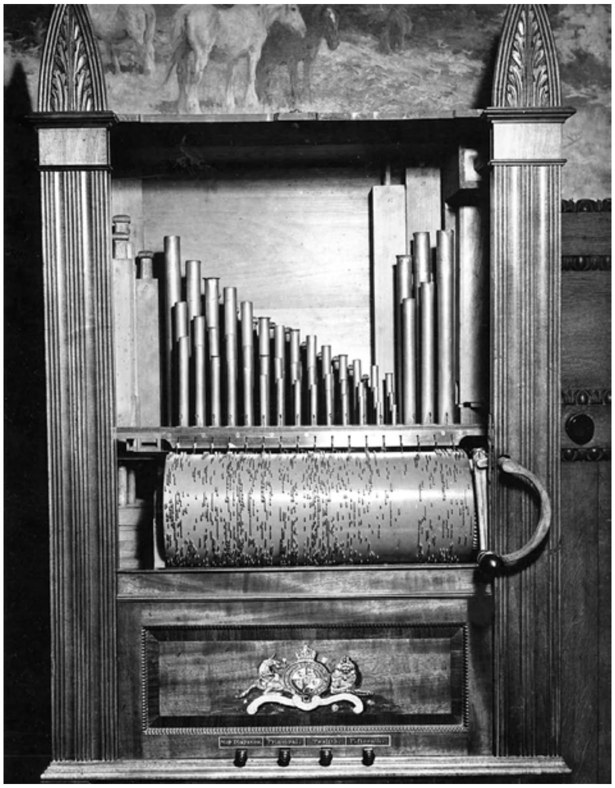

Fig. 55. Church barrel organ, attributed to Bryceson, London (Photo courtesy Arthur W. J. G. Ord-Hume, The Library of Mechanical Music & Horology).

grant Italian musicians had been recalled from Europe by Mussolini (to offset the "negative" image presented of their homeland), manufacture of street and related organs died out soon after World War II.

Like Clockwork

Singing birds, "performing" figurine musicians, and similar cylinder-operated automata continued to intrigue inventors and the rising merchant class that sustained their development from the Renaissance onward. Pipes, longtime components of automata, found new roles in the "flute player" of Jacques de Vaucanson and the "organist" of Pierre Jaquet-Droz, both eighteenth-century clockmakers. But the most significant usage of pipes in eighteenth-century automata was in the musical clock, originally developed in the late Renaissance (the earliest versions used struck carillons) and reaching its zenith in the eighteenth century as the flute-clock. In the latter, hours were announced by pieces played on a set of pipes; the clock mechanism automatically rotated the wooden cylinders. As in previous automata, cylinders were pinned parallel to the cylinder's motion; but by extending the length of the pins, durations could be extended when desirable. (Some systems used "negative engagement," producing sound rather than silence in the absence of the pin.) The pins caused levers to open and close spring valves. The pinning was also designed to shift the cylinder gradually from one side to the other (anticipating the Edison cylinder), allowing for several short pieces or one longer piece to fit on a single cylinder (including works by Carl Philipp Emanuel Bach, Wolfgang Amadeus Mozart, Franz Joseph Haydn, and Ludwig van Beethoven). Larger flute-clocks often had two separate ranks, each with twenty-five or more pipes.

The pinned rotating cylinder was also the mechanism used in the eighteenth-century bird organ (or serinette), designed to teach real birds to sing popular melodies (mostly at 2' registers). Another eighteenth-century automata, the bird flageolet, combined the movement and birdsong of the by-now-forgotten water organ with a child's toy to produce novelty items with "birds" that sprang out of small boxes and flapped wings, charming all who saw them. The crucial difference between these bird instruments and the contemporary flute-clock was that bird automata were operated by a person turning a crank, causing the cylinder to rotate, and so on; this was the basis for the various player organs of the nineteenth century and beyond. Although flute-clocks continued to be popular into the early nineteenth century, they eventually retreated to the role of central European novelty toy.

New Philosophy, Flexible Technologies

The eighteenth century's Rococo leanings toward "magic" gave way to the nineteenth century's Industrial Age fascination with machinery as well as the human connection to it. The portability of the new player organs and the ability of the operator to control the tempo of a "performance" were emblematic of this ethos. (It was no coincidence that hand-operated crank mechanisms were much simpler than self-motivating ones.)

The typology of nineteenth-century mechanical organs falls into three categories: (1) smaller machines designed for use in the middle-class home, in smaller churches, and as a portable music-maker; (2) larger machines such as the ORCHESTRION, producing sounds that, if not replicas of their orchestral counterparts, were nonetheless impressive in their mimicry and multiplicity, and the COMPONIUM, a "self-composing" instrument; and (3) the family of band or fairground organs (also called dance organs or calliopes), originally steam-driven and designed to be heard indoors (in skating rinks, circuses, dance halls) or outdoors (at amusement parks, carousels, on paddlewheel steamboats), featuring characteristic diatonic music wrapped in a swirl of percussion and other strong rhythmic effects.

As it did with the HOUSE ORGAN, the means of providing wind to some mechanical organs changed with the rapid developments of the full-sized pipe organ. While spring-chest and valve-action boxes continued to serve the smaller players of the musical box type, the desire for larger, instrumentlike machines led to the development of quasi-automata. Organs (with or without manuals) used various technologies to simulate performances. Initially winded by treadle-activated bellows (the technology behind the REED ORGAN), player organs were later powered by pneumatic, electro-pneumatic, and electric ACTIONS.

The other important evolution in nineteenth-century automatism concerned the changes in the mechanism that replaced the live performer—that is, it provided the means by which the automaton would know which notes would be played when (and their attendant qualities). The pinned cylinder continued to be used in some organs (notably barrel and, initially, band organs), but its time limitations and the scarcity of machines that could exchange cylinders led to experimentation with different systems. The inventor of the harmonium, Alexandre François DEBAIN, developed the antiphonel (1846), actually a piano or organ player; instead of cylinders and pins, wooden planchettes with hooked jacks engaged iron pegs that acted as the "fingers" on the actual manual. The planchette itself was cranked across the lid of the antiphonel to produce sound. The height of the pegs affected the attack and dynamic level of the playing, a development that would become vital in the development of player pianos and similar instruments.

In a 1775 treatise, Marie Dominique Joseph Engramelle proposed a method of notating the placement of cylinder pins on paper, then transferring the information to an actual cylinder. Although the system was not immediately implemented, it was to be realized more directly in the mid-nineteenth century in the form of perforated cards, with the same alternation of material and lack thereof as the antiphonel's planchettes, but far more practical. The cards (or strips) were hand-cranked between rollers; this created a vacuum that caused the instrument to sound; in a few cases, the "performer" provided the air by blowing into it. In one automaton, J.A. Testé's cartonium (1861), the strips traveled between the lid and a metal ledge that rested above the spring-valve action. This action comprised a series of metal jacks, all connected by a perpendicular rod. Each jack was connected to a lever (sticker) that operated the valve of a FREE REED located below. When a hook (really a small piece of metal) above the jack was held down by cardboard in the strip, its corresponding valve was left open, and the air could not vibrate the free reed. When the hook passed through a hole in the strip, the valve closed and the free reed could sound. The cartonium was essentially the first organette, which became popular in the last quarter of the nineteenth century as a smaller automaton using paper instead of cardboard strips.

The next development was even more prophetic in its implications: a tin disc, perforated, engaging the teeth of a comb. This was originally designed for music boxes, but as the mechanism improved, so did the uses for it. Discs proved easier to change; the device's culmination was the electric disc changer, invented just in time to compete with Edison's cylinder phonograph. It was not long before the flat 78-rpm Victrola disc grew popular enough to eliminate the Edison cylinder from the market (1920s). By the 1950s, manufacturers had developed self-contained "automatic record changers" so that the youth market could play several of the latest 45-rpm popular hits without a break. An earlier form of the "automatic record changers" had already became a commercial boon for soda shops and barrooms everywhere: the jukebox.

The pneumatic automaton became a reality in the mid-nineteenth century. Using cardboard strips, Claude-Félix Seytre's autophon piano (1842) generated pneumatic air with treadle bellows to supply individual key cylinders and their piston-driven hammer mechanisms. By the latter part of the nineteenth century, the pneumatic principle had been applied to the mechanical organ, with foot-operated bellows supplying air to all facets of the action and windchest (in the case of the harmonium, a single windchest for the entire instrument).

In order to play music for longer time periods and allow for full use of stops and other nuances, manufacturers at the end of the nineteenth century developed cardboard "books" in which folded sheets of cardboard were passed through the organ's playing mechanism. Gavioli of Paris and other manufacturers applied this method to the band organ. By the turn of the new century, player pianos (and organs, a few years later) used perforated paper rolls that were more compact, easier to produce en masse, and capable of even longer duration.

Bring on the (Musical) Noise

The final subjects of discussion are the instruments designed to accompany the choir and congregation in church, set the mood for an indoor or outdoor festivity, or simulate an orchestra inside a box.

The cylinder barrel organ was the basis for a chamber automaton that found a home in smaller churches during the eighteenth century. It replaced the English church band, not the most mellifluous of ensembles. George Frideric Handel wrote for the instruments; John Snetzler built them. Despite improvements, e.g., the revolving frame that permitted several barrels to be ready for use in one instrument, the barrel organ's popularity began to wane rapidly in the mid-nineteenth century and it was soon a piece of history. Notably, there are still a large number of working barrel organs, now over 150 years old.

The numerous names given the band or fairground organ suggest their applicability to many settings that thrive on buoyant moods. In their early years (eighteenth century), band organs were basically hand-cranked barrel organs; but by the last quarter of the nineteenth century, large automata powered by steam, water engines, and (later) electricity were being built by some of the most respectable organbuilders of the period. Many of these instruments were keyless (without manuals) and elaborately decorated—that is, designed to be heard and seen. The perforated cardboard "book" allowed for virtually endless music; the perforations caused notes, stops, and the plethora of percussion effects associated with the band organ to sound. In the early twentieth century, WURLITZER and other companies applied the player-organ roll principle to their band organs. Much as tubular pneumatics had presented two options for the organbuilder, so too did the pneumatic mechanisms of band organs have two means of supplying the necessary air: vacuum (negative) pressure (most U.S. organs) or positive pressure (European organs). The band organ had a far greater variety of sonorities, with its flue and reed pipes, than free-reed automata. While the band organ required considerable maintenance and fell out of favor before World War II, renewed interest in organ restoration has spread to organizations dedicated to band organs.

Finally, there are the mechanical orchestras that began with metronome and ear trumpet inventor Johann Nepomuk Maelzel's panharmonicon (1804), a complex barrel organ that used all three types of pipes and air-driven percussion effects to produce an orchestra-like ensemble. The culmination for the panharmonicon was Beethoven's 1813 battle symphony, *Wellington's Victory*, the success of which with its audiences—in an orchestral arrangement—was inversely proportional to its musical worth. It was never heard on its intended instrument.

The orchestrion of the later nineteenth and early twentieth centuries was not the Georg Joseph VOGLER instrument of 1789 (which was not mechanical), but an automata with a mixture of pipes, designed for indoor use and orchestral repertoire. However, the mechanical orchestrion was not a true successor to the panharmonicon; rarely did these large, turn-of-the-twentieth-century instruments possess a wide range of orchestral sounds. Most orchestrions were essentially player keyboard instruments with added percussion and similar effects. So-called orchestrions by Coinola (including its "Midget" model), Lösche (a "jazz orchestrion"), Popper, Romano, Seeburg, Walzen, WELTE, and Wurlitzer often included one or two ranks of flue pipes, but this element merely supplemented the overall sound. The reproduction of an orchestra's sound could not be realized until the ELECTRONIC ORGAN of the computer age, with its digital sampling and MIDI (musical instrument digital interface).

Of the many types of mechanical organs, only domestic barrel organs and cardboard-book organettes were labeled orchestrions. Perhaps if the fashion for mechanical music had survived the arrival of sound recordings and radio, there might have been further development in the direction of a "true" orchestrion; but whatever impetus might have been left was terminated by the economics of the 1930s and subsequent sociocultural changes. As mentioned above, the postwar impulse toward instrument restoration has saved many of the surviving nineteenth- and early-twentieth-centuries' automata; in addition, there will always be hardy souls who build "authentic" or modernized versions of these often extraordinary, sometimes humorous machines.

See also **Player Pipe Organ**

RICHARD KASSEL

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MEDIEVAL AND RENAISSANCE ORGAN

The First Millennium CE

From Hydraulis to Bellows

Although the process took several centuries, the water pressure-driven HYDRAULIS gave way to the BELLOWS (wind-driven) organ, which may have been invented in the second century CE. The principle behind this instrument involved pumping air with "forge bellows"—the sort used to encourage a wood stove fire—through wind channels directly into an area (WINDCHEST) below the pipes or, more typically, into a holding area or RESERVOIR. This reservoir, originally a weighted, iron-framed leather bag, had the dual function of storing wind and releasing it under controlled pressure into the windchest. This system required neither water nor corrodible mechanism to get air to the pipes. A frieze on the base of the so-called obelisk of the Roman emperor Theodosius I (ca. 390 CE) in present-day Istanbul features what may or may not be a true bellows-blown organ, although the two men treading on a pair of bellows could be operating a hydraulis. There is, however, no indication that stops or keylike levers, found in classical Greek and Roman descriptions of the hydraulis, were present in the bellows organ at this time.

The bellows organ did not overtake its predecessor immediately. The hydraulis remained the municipal instrument of choice in the Roman Empire, even after the Western (Roman) sector fell in 476 CE. The great Roman writer on music, Boethius (ca. 480–ca. 524) was reputed to have been an excellent hydraulis performer. Both hydraulis and bellows organ soon disappeared from the lands of the former Western empire; the instrument would not return to the West until the eighth century, thanks to a gift from Constantinople.

Knowledge of the organ survived in Byzantium and was transmitted to Arab theorists, who translated or published treatises on the subject in the eighth to tenth centuries (e.g., in the ninth-century collection attributed to the Banu Musa family of Baghdad scholars). Even those who may have drawn directly on the work of CTESIBIUS (Ktesibios), however, did not refer to the hydraulis. The Byzantine court sponsored a number of organs for ceremonial purposes, including processions, banquets, and races at the Hippodrome. A ninth-century Arab prisoner of war, Harun ben-Jahja, described an *urgana* in the Constantinople court—a square-shaped wooden object with leather, graduated pipes, and a pair of blacksmith-type bellows operated by two men. The Byzantine emperor Theophilus II (reigned 829–842) was especially taken with automata of all kinds.

Christian Rejection

The slow and circuitous route of the organ's return to the West is explained by early Roman church leaders' antipathy to an instrument associated with pagan religion, public spectacle, and (at the time) less than angelic tonal qualities. Much discussion revolved around Psalm l50, particularly verse 5 (King James version): "Praise him with the timbrel and dance; praise him with stringed instruments and organs." ("Organs" attempts to translate the Hebrew *`ughâbh*, "syrinx" or "pipe," or the Greek *orgáno.*) Such references were interpreted metaphorically by early Christian writers, who felt the human voice was the appropriate means of religious expression: Clement of Alexandria (d. ca. 215), St. John Chrysostom (ca. 347–407), St. Augustine (354–430), and St. Jerome (ca. 342–420), who, when advising a woman on how to raise her young daughter as a virtuous Christian, suggested, "Let her be deaf to the sound of the organ." Instrumental music risked the kind of sensual beauty that could spur one into committing every conceivable sin. More inflammatory commentators falsely associated the use of instruments with Jewish as well as pagan practices (all instruments had been banned from Jewish worship since the days of the Old Testament prophets). In the first century CE, musicians had the choice of giving up their profession in order to become Christians; by the fourth century, they were being excommunicated outright.

The Early Cathedral Organ

In European politics of the eighth century and beyond, the organ was sufficiently prestigious so that, when the Byzantine emperor Constantine V (Copronymus) sent gifts to Pepin III (the Short), king of the Franks in 757, he included an organ "with great leaden pipes" (more likely a hydraulis than a bellows organ). The instrument, apparently moved to St.-Corneille in Compiègne (Picardy), may have been requested by Pepin some years earlier. The organ was so impressive that Pepin's son, Charlemagne, supposedly requested a similar instrument from either a Byzantine leader or the caliph of Baghdad; it arrived in 812 and was placed in a church at Aix-la-Chapelle (Aachen). In 826, Georgius, a Venetian cleric who may have spent time in the East, erected either a bellows organ or a hydraulis for the palace of Louis I (the Pious) at Aix-la-Chapelle—the moment of rebirth for the Western organ.

Soon after Gregorius's accomplishment, brothers in Christian monasteries began to build organs; many of these were hydraulic with a rough and loud tone, and initially functioned as signal organs rather than as liturgical participants. They were used to teach chant to monasterial choirs. References to organs began to crop up regularly, starting with Pope John VIII's request, to Bishop Anno of Freising (Bavaria), for an organ to be sent to Rome, along with an organist (873). References to ninth-century Continental instruments include the Benedictine abbey in Bages (Catalonia) and the cathedrals of Cologne, Rheims, and Halberstadt (Saxony, predecessor to the well-known 1361 organ).

In England, future saints were credited with building organs. In the seventh century, Maeldulph, a transplanted Irish monk, is supposed to have built instruments; and Dunstan, Archbishop of Canterbury (909–88), an expert metal worker, built instruments for Glastonbury Abbey and elsewhere. An anonymous signal organ "with a strong blast bellows . . . a sweet melody and a far resounding peal" was donated to a convent in Ramsey in the tenth century. The most famous early cathedral organ is attributed to Ethelwold of Winchester (ca. 912–984); it inspired the first thorough description of a bellows organ. According to the English chronicler-poet Wulfstan of Winchester (late tenth century), the instrument had twenty-six bellows (requiring "seventy strong men"), forty notes of ten pipes apiece, and a divided set of perforated sliders requiring "two brethren of concordant spirit . . . each managing his own alphabet," a diatonic (white-key) scale, plus B♭. The hyperbolic Wulfstan compares its sound with "thunder; the iron tones batter the ear . . . reverberating to such a degree, echoing in every direction, that everyone stops his gaping ears with his hands, unable to draw near and bear the sound that so many combinations produce. The music is heard throughout the town and over the whole landscape."

Notwithstanding Wulfstan's exaggerations, his reference to unbearable "combinations" of sound suggests important elements of the early medieval organ. The "ten pipes" represent one (of forty) key's pipes, for a total of ten ranks, each with a distinctive metal flue tone. However, there were no stops to shut off (or highlight) one timbre from the rest. The Winchester organ was, in effect, an unrefined and indivisible BLOCKWERK; one can imagine the effect that early multipart music ("polyphony") would have generated on an already noisy instrument. Clearly, the organ would need considerable rethinking before the Christian church would ever ponder its inclusion in worship.

From Signal to Sonority

Renewed Opposition

Indeed, the organ in the first few centuries of the second millennium CE continued to experience rejection among theologians and church leaders such as Thomas Aquinas (*Summa theologica*) and Aelred (1109–67), Abbot of Rievaulx (North Yorkshire), who referred to the sound Wulfstan had praised a century earlier as "that terrible noise of blowing of bellows, expressing rather the cracks of thunder than the sweetness of a voice." The cathedral organ of this era was difficult to play; a performer was referred to as *pulsator organum* (organ beater) because of the heavy action that required fists to play. But while the Byzantine (Orthodox) church continued to ban instruments from its worship, monastic Western churches began to incorporate organs into their buildings, a trend that grew as technology improved and choices of sonority increased.

Theophilus Offers Direction

Monastic churches had the personnel (organ-building monks) and the economic wherewithal (thanks to the nobility and ecclesiastical hierarchy) to experiment with and erect new instruments. The best description of these instruments comes from two sources: the anonymous *De fistulis organis* (On organ pipes) from the Berne Codex (?Fleury, eleventh century), and a section from *De diversis artibus*, a compendium of the arts by a German Benedictine, THEOPHILUS (eleventh century), who describes the construction of metal pipes, wooden cases, key sliders, windchests, and a winding mechanism encased in a "conflatorium," a structure in which a set of forge bellows feeds air through tubes into a central channel; the air pressure is controlled by valves on the tubes (anticipating the spring-chest and Sperrventil.) Theophilus writes in great detail, makes some ambiguous statements, suggests that all pipes be of equal thickness and (from the languid down) length, and tells the would-be builder to look elsewhere for information on pipe scales. The resulting instrument would have been "old-fashioned" in sonority (more rough than sweet) and be used for monophonic music, but the design was sufficiently compact to be built into a wall, with only its chest and pipes visible, rather than a gallery; this was a SWALLOW'S NEST organ, resting "in space" rather than standing on the ground. A very free "reconstruction" of this organ (van der Putten, 1999) borrows from a late-thirteenth-century miniature in the Rutland Psalter; it places the instrument on a floor or table (like a positive), and uses wooden instead of metal pipes (for a softer tone), a *pulsator organum* levered proto-keyboard, and a latch-down drone device.

The Positive Organ

The POSITIVE or CHAMBER ORGAN developed around the same time as the cathedral organ. Although far smaller than its counterpart, it still required a second person to operate the bellows. It had one manual (pedals were not yet invented) and was movable, but not easily portable; thus the etymological reference to "position." A positive (like van der Putten's Theophilus reconstruction) could be built to stand freely on the floor or rest on a table or stand; its overall height (including any table or stand) might reach over ten feet (if 8' pipes were used), but most positives would have been limited to 2' and 4' pipes, in which case their overall height would have matched human stature.

Polyphonic keyboard music requiring two independent hands is first documented in the Robertsbridge Codex, from around 1325 (British Library), and in ICONOGRAPHY. Clearly, the earlier KEYBOARD technologies (slider keys, the pivoted levers of Hero) would not have permitted the performance of this relatively virtuosic music. During the fourteenth century, the pin ACTION was developed. A pin was attached perpendicularly to the bottom front end of a buttonlike key. When the key was depressed, the pin pushed down a pallet held by a spring, forcing it open. This allowed air to escape upward from the pallet box (really a miniature windchest) to enter the groove, or individual pipe chamber (later called a KEY CHANNEL) above the open pallet. As a result, the particular note would sound. The simplicity and directness of this action led to the creation of a lighter touch and what can be viewed as keys, albeit narrower and shorter than the modern variety. While ranges differ, the keyboards of some instruments had a nearly chromatic COMPASS of two octaves or more. While representations of positives are at times unreliable, there were at least two ranks; pipes were generally of the metal flue type, although BOURDONS were sometimes used for bass notes.

Freestanding positives required at least two bellows of the hand-operated forge variety or the treading type requiring full-body participation (as in the Rutland Psalter miniature). The smaller table positive could be winded without difficulty by lifting weighted bellows in alternation, as shown in Israel van Meckenem the Younger's (ca. 1445–1503) engraving of an organist and his wife.

He is playing the keyboard while she sits on the table, calmly moving the WEDGE BELLOWS. Two devices represent new developments in early Renaissance organ building. The wedge bellows comprise hinged wooden boards and ribs, attached to leather strips, which collect air as the bellows is being raised. This air is then forced by weights into the wind channel under the pipes. Second, there are four small pluglike objects on the side of the positive facing the viewer; these may be decorative or, more interestingly, the external controls of a SLIDER system to turn ranks on or off. This early STOP system would have divided the monolithic Blockwerk to its constituent sonic parts. Later, positives increased the numbers of stops and added pedalboards.

Besides its use as a domestic instrument, the positive found a place in the medieval and Renaissance church. Most large cathedral organs were built above

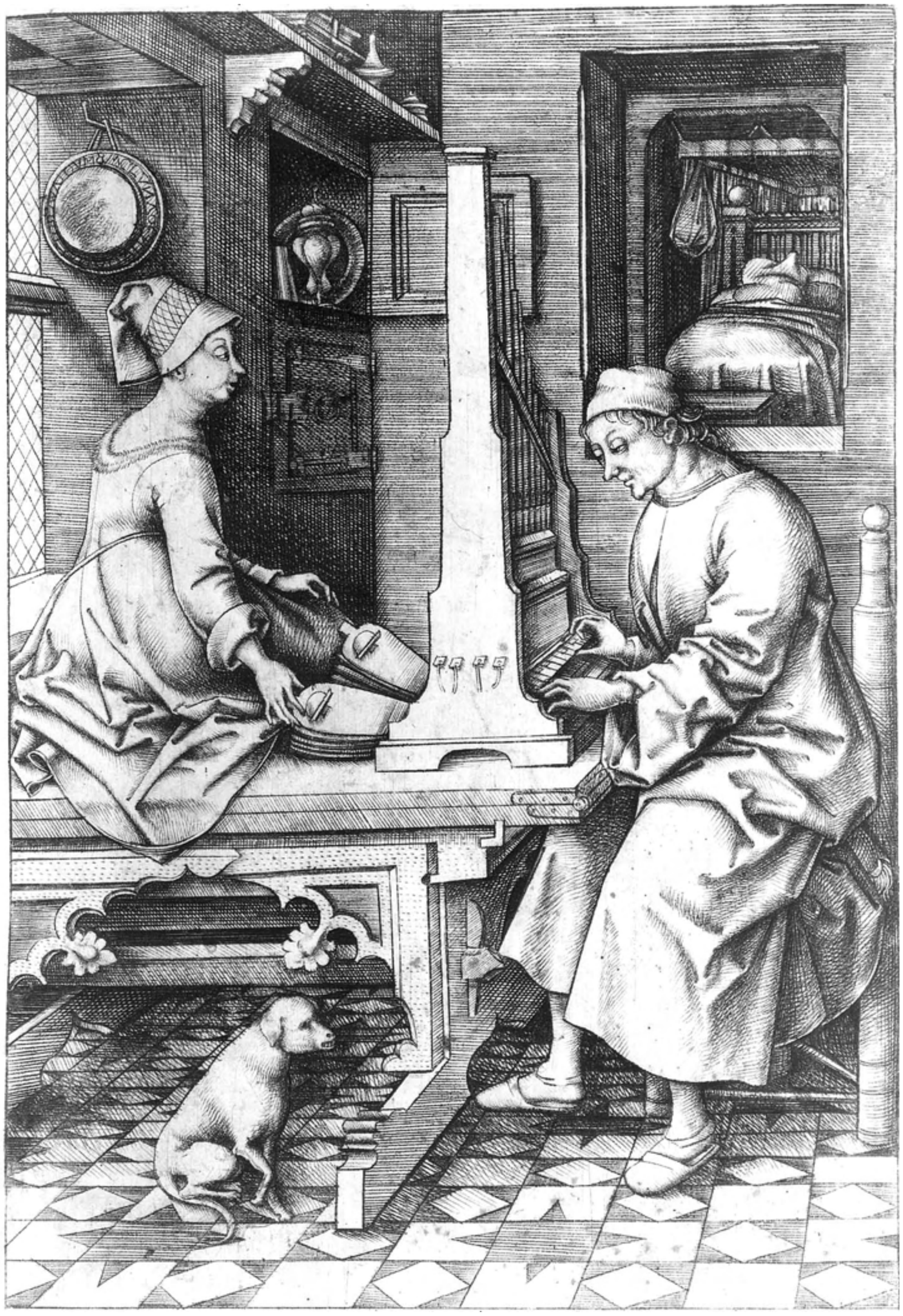

Fig. 56. "The Organ Player and His Wife," ca. 1495–1503, engraving by Israel van Meckenem the Younger; National Gallery of Art, Washington, Rosenwald Collection, 1943.

in a gallery or loft, making it difficult to accompany the increasingly common choirs (as opposed to congregations); smaller positives could be placed on the floor where the choir stood. Furthermore, organbuilders began to place a positive behind the cathedral organ bench, allowing the player to shift between instruments; the positive faced the choir, aiding its role as accompaniment. The development of what became known as the RÜCKPOSITIV or CHAIR ORGAN had significant implications for organ building. The relationship between the main organ's manuals and the Rückpositiv later evolved into a separate manual, incorporated as a DIVISION of the main organ.

By itself, the domestic positive evolved into the HOUSE ORGAN, popular with performers who practiced on their own time, or with the well-to-do amateur. Two well-known representations of a positive are found on fifteenth-century tapestries; in both a noblewoman plays a positive as it rests on a table or stand. In one image (Angers Castle, Anjou), the woman sits; the bellows are operated by a boy; and, to their right, a man of equal station to the woman seems to sing to her accompaniment. The other tapestry (Cluny Museum, Paris) is part of a famous series known as the *Lion and Unicorn*, incorporating the theme of the human senses. In the tapestry devoted to hearing, the performer stands to play, and has only a young woman operating the bellows for human company. A lion and unicorn stand guard on either side of the pair; several small animals have gathered around to listen.

The Portative Organ

The PORTATIVE, better known in its day as the "little organ" (*organetto*, *organino*), was the last of the three organ types to develop, probably in the twelfth century. As its name indicates, it could be played anywhere, e.g., slung over a shoulder during processions, or placed on one's lap. It required only one person to play, with the right hand playing a single manual with a range of two octaves or less, the left manipulating a small forge or simple wedge bellows (without weights) to provide air. There was at most a small wind channel, with the air being forced into the small cavity below the pipes. Depressing the pin-action key by button (later protomodern keys) opened the pallet and allowed the air to sound the desired pipe. The portative's main limitation was that the bellows provided air only when pushed down; like a singer, it had to open its "lung" to fill with air, and no sound was possible during that time. The best portative players would have, in effect, had to breath as if the instrument was their own voice.

The portative could have stops like those found on some positives, but the instrument was designed for practicality, and would have been limited to one or two ranks. Its compactness and treble range made it an ideal instrument for solo and accompanimental roles; the highly respected Florentine composer Francesco Landini (ca. 1325–1397) was even more revered for his playing as organist at Florence's San Lorenzo (for over thirty years) and of the organetto (he is depicted playing one on his tombstone). His surviving music (entirely secular) demonstrates the virtuosity demanded of the medieval portativist (also apparent in the Robertsbridge Codex), whether alone, doubling a voice part, or in ensembles of instruments or instruments and voices. (Purely vocal polyphony would be more characteristic of the Renaissance era.)

The portative usually served less virtuosic purposes: as a processional instrument in churches and other settings on feast days (excepting Lent), doubling the chant line for the congregation; for use in the feasts and private chapels of nobility and wealthier merchants; and in the popular miracle and mystery plays (especially in Britain). Of the three types of organs, the portative was the most favored in paintings and illuminations. With its relatively simple external appearance and small size, it was a natural instrument for angels in flight, joining their colleagues with other portable instruments. Modern iconologists refer to such images as attributes, rather than as representations of musical performance; this explains the many technical problems presented to organologists who analyze these images for technological information.

By the early sixteenth century, the term *portative* was applied to the positive and even the REGAL at will. With the struggles between Henry VIII and the Roman Church, the outdoor religious play ceased to be a viable form of edifying entertainment in England. Finally, the cathedral organ's increasing tonal complexity and infinitely greater power must have made the portative seem tiny indeed. The instrument became a relic, found primarily in Pre-Raphaelite paintings attempting to evoke "the music of a bygone era." The portative has been revived by organbuilders (and amateurs) for commercial or practical reasons, but it has not figured in the music at the turn of the twenty-first century.

A Technological Sea Change

The cathedral and church organs of the late medieval (Gothic) period and pre-Reformation Renaissance had become secure in their role, notwithstanding centuries of objection; their power helped convince congregations of the theological or (increasingly) sociopolitical matter at hand. With financial support firmly in place, instrument makers and their advisers wanted to increase the instrument's possibilities while refining the means of revealing them. On one hand, organbuilders expanded the tonal range (color), increased the number of available pitches and registers, and enlarged the instrument's size and power, in part by adding manuals (later paired with couplers) and introducing the PEDALBOARD, a "manual" for the foot levers. On the other hand, builders sought ways of silencing ("stopping") certain ranks while others sounded; they also wanted to refine the windchest and action of the increasingly larger instruments. The only area where organs remained fairly consistent was in the supply of wind using single or multiple pairings of wedge bellows (single or multifold), motivated by hand, body weight, or weighted levers in alternation. In all cases, air was forced out of the bellows through wind channels into the windchest, ready to feed the pipes, controlled by whatever stop-and-action combination was in use. Generally, WIND PRESSURE was kept at the lowest possible level to sustain the sound in a given space, an approach that held through the Baroque era as well.

Timbre

A draft of a treatise by Arnault de ZWOLLE dating from the 1440s (Paris, Bibliothèque Nationale) provides the first surviving writing on pipe measurements and registration. Arnault, a Dutch member of the Burgundian court, describes pipe scaling in some detail, including proportional formulas involving the mouth, cut-up, and foot. There are drawings of the fronts of one-rank organs (probably portatives), with pipes arranged either chromatically (the "usual" manner, perfect for direct pin action) or "like a bishop's miter," with tallest pipes in the middle (which requires different action mechanics not described by Arnault). There is also the earliest mention of a reed pipe, but no further details.

Arnault describes the registration of a few Burgundian organs he knew. At Notre Dame in Dijon, there was a sizeable instrument with twenty-six ranks and over 750 pipes, large enough to have four separate Blockwerks. Each of these Blockwerks could be said to constitute an independent CHORUS. One of the Blockwerks, however, is further divided by Arnault into a group of MIXTURES (compound stops), later known as the PLEIN JEU: PRINCIPAL 8' (four high ranks), Cymbale (CYMBAL or ZIMBEL, three high ranks, including the first documented mixture TIERCE), and Fourniture (fourteen remaining ranks, a mixture with breaks in upper registers). The separation within this Blockwerk suggests the introduction of stops, the technology of which is unknown (perhaps sliders).

Zwolle also describes three organs in Salins, Franche-Comte, one comprising a 4' Blockwerk with a true Fourniture. He examines Trompes (bass pipes) found in two churches (Nevers, Cathedral of St. Cyr, and Ste. Julitta; Dijon, Église des Cordeliers). These *fistula tenoris* ("tenor player"; Lat. *tenore*, "to hold"; usually the lowest medieval part) were apparently played on separate keyboards (of the one-hand-per-note variety); combined with the regular manual in performance, this suggests the instrumental performance (or at least doubling) of the medieval genre organum *à* 2. The Dijon Cordelier chapel organ had a divided Principal and a total of five registers (each with one QUINT, two octaves and a fifth above its fundamental); these may also have been made into stops. Finally, Arnault describes a one-manual, three-octave Blockwerk positive with multiple ranks at 4' pitch, noting that the front (FACADE) pipes are made of tin, the interior ones of lead. This placement of visually appealing metal in the case suggests the PRESTANT, by then the design norm for all organs. Later builders put nonsounding (dummy) DISPLAY PIPES in various chests, using inexpensive metal or wood painted silver, gold, or bronze for purely aesthetic reasons.

The pattern of Principal (in England, the Open DIAPASON), Mixture (Fourniture), and Zimbel (sometimes called SCHARF) remained the standard design for fourteenth- and fifteenth-century builders. However, surviving registrations reveal that specific "color stops" were being developed. In his *Spiegel der Orgelmacher und Organisten* (1511), Arnolt SCHLICK describes an ideal two-manual plus pedal instrument, involving the HAUPTWERK (GREAT; Fr. GRAND ORGUE; Dutch *Hoofdwerk*) and the Rückpositiv (Fr. *Positif de dos*; Dutch *Rugpostief*) with a mix of imitative FLUE and REED stops, including two GEMSHORNS (ram's horns), a ZINK, FLAGEOLET, REGAL, and RAUSCHPFEIFE (either a small FLUTE compound stop or an imitative reed). The Pedal has two "transmitted" stops (from the Hauptwerk) and two of its own, including a Trompete (TROMBONE or Posaune). Most organs built in the half-century or so before Schlick's publication remained faithful to the three-division standard, whether in northern (Netherlands), central (the Rhine region), or southwestern Europe (Iberia) This same period probably saw the introduction of the STOPPED PIPE, in which a pipe of a given length, closed off at the top, produces a pitch a octave lower than that length normally produces, with an emphasis on odd-numbered partials (e.g., QUINTATEN or Quintadena, a Flute stop with a strong twelfth, i.e., third partial).

Breaking Down the Blockwerk

Once divisions and, later, individual stops could be separated out from the Blockwerk (see above), even more experimentation with individual pipe tone and the combination of tones, whether through cross-family mixtures or the blending of MUTATION stops, took place. In the latter fifteenth and sixteenth centuries, many new stops were created. Imitative stops were naturally named after the instruments themselves—Cornett (similar to the Zink), Bagpipe, TRUMPET, KRUMMHORN (Cromorne), DULZIAN (not Dulcian), SCHALMEI (shawm), Sackbut, and RANKETT. The Flute (Flöte), always the most prominent flue pipe, developed several variants: HOHLFLÖTE (hollow), ROHRFLÖTE (chimney), SPITZFLÖTE (pointed), and Offenflöte (open), as well as the PIFFARO, Hörnlein, Untersatz (the positive's Bordun an octave lower), and Grobgedact ("coarse and covered"). There were new reeds: BÄRPFEIFE, CLAIRON, and SORDUN. Terms like the SIFFLÖTE and NACHTHORN (night horn) were applied but never clearly defined.

The traditional mixtures (Fourniture, Zimbel, and Principal chorus) were the first to get their own stops; but builders began inventing their own combinations, mostly by isolating a section of the overtone series and calling them simply "mixtures." In addition to the many chorus ranks referred to by their interval above the fundamental (TWELFTH, NINETEENTH, Twenty-second), flute mutation ranks such as the perfect fifth above 8' (5- 1/3', the Nasard), the major third above 2' (1-3/5', the Tierce), and the perfect fifth above 2' (1-1/3', the Larigot) were given distinctive, "nasal" tones that became essential to the French classical organ of the Baroque period.

In France, the Principal was subdivided into the Montre (8' or 16'), Prestant (4'), and DOUBLETTE (2'); on the Pedal, the names were applied to ranks an octave lower. Builders also added tremulant effects (vibrato), toy stops, and moving figures reminiscent of clocks and other automata popular at the time (e.g., angels raising trumpets to "play").

Another development (fifteenth century) was the beginnings of what would later be called the WERKPRINZIP. In addition to the association between a manual and a division, the pipes of different divisions were separated in the organ CASE itself, comprising dedicated CHESTS (compartments) for different choruses and mixtures. This made it possible for builders to increase the flow of wind and direct it in order to improve its distribution.

Renaissance Expansion

The growth of the Renaissance church organ was manifest in the work of northern and central European builders especially. The number of divisions (and usually manuals) increased. The Rückpositiv began to be incorporated within the main case as the POSITIV (Fr. *Positif*; Dutch *Positief*), usually located near the Hauptwerk chest. Then new divisions were added, although there was no set order, and terminology was not totally consistent. The BRUSTWERK ("breast division," described by Schlick, but a later term; Dutch *Borstwerk*) was a Positiv-like small department whose pipes were located just above the manuals, under the central Hauptwerk division. Even when the Rückpositiv was integrated into the main organ, the Brustwerk sometimes survived as a subsidiary REGAL organ or as a "Brustpedal" division played on the pedalboard. The OBERWERK ("upper division") was sometimes synonymous with Hauptwerk, but in other cases was a subsidiary department (Dutch *Bovenwerk*), separated from and placed above the Hauptwerk, able to support weightier pipes than the Brustwerk and other smaller divisions.

The most significant development was the emergence of the PEDAL division, which had its origins in the latched drones of the early medieval organ. The earliest pedals were PULL-DOWNS, in which the foot "levers" (keys) were attached by wire or rope to the pallets of the manual closest to the player; later, the connection between pedalboard and manual was more sophisticated mechanically (transmission), permitting greater flexibility. The earliest pedals did not necessarily play the lowest notes of an instrument. In the second volume of his *Syntagma musicum* (1619), Michael PRAETORIUS describes the organ at Halberstadt Cathedral (Nikolaus Faber, 1359–61; reb. G. Kleng, 1495; lost). The instrument had four manuals of limited compass (twenty-two keys in the upper two manuals, twelve in the lower two). The organ was divided thus: Clavier I, full organ—that is, Principal/Prestant plus the so-called HINTERSATZ or Hinterwerk, a chest located behind the Prestant; Clavier II, Principal/Prestant only; Clavier III, the Bassklavier, playing a set of large pipes located to the sides of the main organ; and the Pedal, possibly a pull-down of Clavier I that played the cantus firmus (chant or chorale melody) rather than a bass line. The Halberstadt manuals were not keyboards so much as rows of levers, with space between the naturals and accidentals as well as between levers. Hands, not fingers, were required to play the upper manuals; Clavier III may have been played by hands or knees, the Pedal by knees.

Even as this organ was being built, true Pedal divisions were being developed. Many organs had side chests for bass pipes, sometimes above ground level, like a swallow's nest. Later, these pipes (16', eventually 32') were encased on the floor in paired PEDAL TOWERS, usually off or connected to either side of the organ. As larger instruments were built, additional chests were placed between the central main chest, housing the CONSOLE (manuals, stops, other mechanical devices), and the towers, forming FLATS. The knee or foot levers were placed on the floor and made into a pedalboard, played by the feet exclusively. Even in their pull-down phase, pedalboards had served as an alternate manual; the new Pedal division incorporated this by including 8' and 4' stops (and occasionally mutations) in its registration.

Praetorius also describes David BECK's organ for the court chapel at Groningen, Netherlands (1592–96;

2/57 plus Rückpositiv; reb. Christoph CONTIUS, 1704; case survives, Halberstadt Martinskirche, 1770). The large number of stops on this late Renaissance organ is offset by there being only two console manuals; the Rückpositiv is still separate. The Pedal is distributed among an Oberlade ("upper chest," or Oberwerk), pedal towers, and "side Brustwerk"; metal pipes are used exclusively (avoiding wood pipes that held up poorly in the north and were difficult to keep in tune); and a Sperrventil ("blocking valve") regulated the flow of air into a chest or division. The Beck organ at Groningen demonstrates the prototypical northern builder's pleasure in what Schlick called "a lot of sauce for not a lot of fish." By comparison, the NICOLAS BARBIER organ at Gisors, St. Gervais-et-St.-Protais (1577–82; rest. and Récit added, J.-B. N. Lefèvre, 1769–74; destr. 1940) originally had only twenty-one stops on its two manuals and a Pedal of only two 8' stops, included a reed (Sackbut), with its pipes placed in chests to either side of the main case. The Positief was not separate, but part of the main case of the Grand Orgue, which used a spring-chest.

The COUPLER allowed the two manuals to sound when playing only one. The first coupling devices (fifteenth century) were of the SHOVE type; by the next century, mechanical means had been developed to "communicate" between manuals in this manner. Only four treading bellows were used for the Barbier organ; at least twice that many would have been needed for the Beck. On the other hand, the Barbier had five mixtures (and two mutations), while the much larger Beck had no mixtures (albeit six mutations). Although later northern builders such as Arp Schnitger included mixtures as a matter of course, the emphases typical of what became the French and German Baroque styles were already present a century or more earlier.

Making Sound Choices

Yet what permitted the separation of those individual ranks? Initially, the groove (individual pipe chamber) of the pin-action Blockwerk organ was divided in two; each "half-chest" had a separate set of pallet and pallet-springs, and some ranks could be kept from sounding. But references in surviving documents (mostly building contracts) of the latter half of the fifteenth century suggest that the sliders of the long-forgotten hydraulis were reintroduced to the late medieval organ. These were placed parallel to the keyboard in the main body of the instrument, one per rank, with perforations that, depending on the slider's position, kept air from or allowed air to enter that rank. Here is the source of the original meaning of "stop": the CALCANT pushed in (activated) a slider to stop air from flowing into the pipe mouths, and pulled out (deactivated) a slider to allow air to flow freely into the mouths and produce sound. Thus the Blockwerk in its entirety was the norm, reduction of its forces the alternative.

Although early sliders had to be operated by someone other than the organist during performance, a stop mechanism was developed to allow changes to be made from the bench by the performer. Pulling out a drawstop at the console would set in motion a trundle (vertical rotating stick) that in turn set in motion the movement of the slider into open (audible) position; pushing the stop knob back caused the stop to cease sounding. This device made possible the slider-chest's renewed popularity in the late Renaissance and Baroque eras; but it required another technological change. To allow the sliders to fit snugly between the groove and the pipe board, the action was adjusted so that the keys were below the pallet. This led to the first stage of mechanical (tracker) key ACTION, in which a centrally pivoted key (now a lever) was depressed, engaging a STICKER, BACKFALL, and TRACKER assembly that sounded a note when the tracker pulled down its pallet.

The slider-chest remained in common use to the end of the Renaissance, but not without competition. The spring-chest, developed in the early sixteenth century, had the identical system to the slider-chest until the point where air was allowed into the groove. Instead of sliders, each stop had an additional small pallet-and-spring assembly, called the groove valve. The availability of a stop depended on the position of a stop-lever bar above and to one side of the valve. If the bar was latched in an upward ("on") position, the valve was able to open and air was able to travel though a tiny channel into the pipe mouths; if latched "off," the bar fell downward, preventing the valve from opening and allowing air in. There were variations of the spring-chest, and not all were pleased by its greater demand on space and manufacturing difficulty when compared to the slider-chest. The spring-chest sustained more accurate tuning (having no vulnerability to atmospheric conditions, unlike wooden sliders), but the metal springs were more sensitive to extreme weather changes (northern and central Europe), and the spring-chest was limited to southern Europe (Italy, Spain) by the early Baroque.

Finger Control

The pin actions of the early pallet-and-spring-chests were inadequate for larger instruments; there was too much distance between key and pallet, insufficient leverage for the increasing numbers of ranks and stops on each key, and the need for relatively narrow keyboards and placement of chests outside the main organ's span (meaning that pipes and their individual pallet chests could not longer stand directly above their associated keys). In a moment of engineering genius, a builder of the latter fourteenth century realized that the action of a key could be transferred (transmitted) across the width of an organ to the appropriate pipe or pipes by using a ROLLERBOARD and a set of rollers, one per key. Once initiated, the roller was pulled "forward" (toward the manual), causing a tracker at the other end to pull down the pallet. The rollers were all attached to the rollerboard so as to be free to respond to the key action and transfer it successfully.

The tracker action mechanism went through additional refinements; the one most common during the fifteenth and sixteenth centuries is called suspended action. In this system, the key rests on a fulcrum at its back end, rather than a centrally located pivot; depressing the key pulls down a tracker connected directly to the roller arm, with the same result (the opposite tracker pulls down the pallet). Despite its simplicity and light playing touch, this system was challenged by balanced action (except in France, which retained suspended action into the early Romantic era), although it never disappeared entirely, and was revived in the twentieth-century organ revival. Balanced action is applied to two ways. In the manuals, the initial sticker is replaced by a "dogleg" joint between the manual key and backfall. Depressing the key raises the front of the backfall, which in turn pulls down the tracker connected to the roller's short arm; the rest of the action is unchanged. Balanced action is most effective on the pedalboard. Depressing the front of a pedal pushes down a sticker, moving the front-lower end of a square downward. Pivoting on its fulcrum, the back-upper end of the square pulls a horizontal tracker that opens the pallet of the pedal chest (which lies horizontally rather than vertically, as in the manual chest). Both kinds of balanced action were better designed for larger instruments (especially with detached consoles) than suspended action, explaining their popularity in the grandest Baroque instruments (outside of France).

The many technological developments of the latter medieval and Renaissance periods helped expand the scope of European organ building in the ways described here. Another seems almost a by-product of these changes—the expansion of the average keyboard compass from two to four fully chromatic octaves. The single manual of the Graziadio Antegnati organ at Brescia's San Giuseppe (1581) had fifty-three notes covering five octaves, the lowest being a short octave with accidentals and one natural omitted. The increasingly diatonic (late modal) nature of sixteenth-century music allowed for certain "bass notes" to be left out; composers simply didn't ask for them, a classic example of the symbiosis between musician and instrument maker.

Organ-Building Schools and Their Music

Analyzing the national schools of organ building in the medieval era is quite speculative. Only a small amount of clear documentation and virtually no instruments survive; the earliest organs date from the late fourteenth century and are by no means in their original state. There are far more examples of music than dispositions, and only Theophilus provides useful building information before the fifteenth century. What exists comes from surviving contracts, other church documents, and the occasional letter or other description. Beginning in the mid-fifteenth century and accelerating in the fifty years or so leading up to Schlick's *Spiegel der Orgelmacher*, more information has survived about instruments and their builders. One can study not only individual instruments' dispositions, but the presence of certain builders, building families, and early "dynasties": master-apprentice relationships that transcend the passage of time, bloodlines, and geography. Surviving music can allow one to see connections between it and the instruments of the period; this is especially effective when a composer of organ music is known to have played a particular instrument about which something is known.

Germany

During the medieval and Renaissance periods, Germany was really Germania, a large central European collection of geopolitical units of different sizes and strengths. From the moment Charlemagne accepted the crown of the Holy Roman Empire, Germany became the ideological center of European Christianity. Echoing events during the first centuries CE, conquerors brought their religion with them and imposed their beliefs (or death) on defeated "pagans." Christian churches were built in cities, towns, and villages as financial and ecclesiastical power spread; those who were able created parish churches in the spirit of monastic churches, royal chapels, and diocesan cathedrals. The organ overcame previous reluctance to become as important a status symbol as the altar, iconography, ecclesiastical objects, and the church building itself. It also suffered the same risks: aging, fire, flood, war, and, beginning in the sixteenth century, the wrath of Protestant iconoclasts. Opportunities for new instruments grew with the religion; tuning and maintenance were service trades, and repairs a frequent necessity. By virtue of its size, Germany produced many builders who gained reputations throughout the region and, on occasion, outside it. The German market was large, however, and builders did not have to travel far for work. Generally, the further to the northwest a German duchy or principality was, the more progressive a builder working there tended to be. There was considerable cultural exchange between German organ makers and those in the Low Countries, among the more innovative of European builders.

The first major figure was STEPHAN KASCHENDÖRF, active in Saxony and Swabia from the mid-fifteenth century on. Among the first to develop a separate Rückpositiv, he began dividing the Blockwerk into independent divisions. Heinrich Traxdorf (fl. 1440–44) was also progressive (Nürnberg, Sebalduskirche, 1444; reb. 1691, 2/17, played by Johann Pachelbel). At the other end of the spectrum, the more conservative Friedrich Krebs (d. 1493) was active in Franconia (from 1471), although he is best known for his work in Strasbourg, then an independent "imperial city" (Notre Dame Cathedral, 1478, 1491–92). The even more conservative Burkhart Dinstlinger (fl. 1474–1507) was active throughout southern Germany (Freiburg, Cathedral, 1502) and Austria, particularly in Innsbruck (St. Jacob, 1484). Dinstlinger's late Gothic organs featured Principal stops and limited the use of reeds.

The records of the Zwits clan, an organ-building family of apparently German origin, are complicated by the use of several different names, even for the same person; there are also questions of nationality. The earliest member of this "family," Lieven Zwits (fl. 1438–69), was said to be "from Cologne" and a resident of Frankfurt-am-Main at one point. He built organs in the Low Countries and Germany. Joost Swijssen worked at Antwerp, Sint Joris (1510). Sebastian Zwysen, called "van Diest [Belgium] alias Moukens" (fl. 1523–27), worked in Hasselt and Diest. The most significant member of this dynasty, Hans SUISSE, may have come from Nürnberg or Cologne. Active by 1498 until his death in 1544, Suisse worked on several organs in Antwerp (Notre Dame, 1509–14; his best-known work), Cologne, Frankfurt, Strasbourg, and smaller cities.

German organbuilders of the first part of the sixteenth century continued to dissect the Blockwerk while experimenting with new stops and combination. In addition to his building (Trier, Cathedral, 1537, 2/18; incorp. F. Hocque, 1590–93), the Rhinelander Peter BREISIGER developed new stops (including compound types) and wrote about registration. Jörg EBERT was active in Ravensburg, Franconia, and internationally, and used some new imitative reeds (Innsbruck, Hofkirche, 1555–61; 2/16). Friedrich Pfannmüller (ca. 1490–before 1562) worked in the Upper Palatinate region (from 1538), explaining Flemish influences in his otherwise Gothic style (Prague, St. Vitus, 1553–62; compl. Ebert). Stuttgart's Johannes (Hans) Schentzer (fl. 1508–42) built an instrument for Strasbourg, St. Thomas (1515) and repaired the Hans Suisse cathedral organ there (1542).

With the approach of the seventeenth century, a few major figures and several important families asserted their place in European organ making. Among individual builders, NICOLAUS MAASS built large organs in a high Renaissance style, with well-defined divisions, some use of mixtures, and few mutations. He worked in Saxony, Brandenburg, and Mecklenburg. In 1603, he emigrated to Denmark to became royal organbuilder, replacing Hans Brebus (see below). In 1608, Maass built an instrument for Flensburg (then part of Denmark) at St. Nikolai (reb. Schnitger, 1708; 3/38). His last major work, for the Danish royal chapel in Frederiksborg Castle, was completed by Johan LORENTZ, a former apprentice to Maass (1617, 2/28; burned 1859).

The Beck family, based in Halle, built similar organs that helped to establish the central German Baroque style; David Beck's Groningen court chapel organ is discussed above. The Graurock dynasty began when Berndt Granbom (d. ca. 1519) worked in Emmerich with a relative, Johann (Hans) Graurock the Elder (d. by 1558). Johann lived and worked in Zutphen (Netherlands, 1534–47). Working in the lower Rhine region, the Graurocks followed local trends in splitting the Hauptwerk and placing one part of it (the Oberwerk) immediately above the main division. The last known Graurock instrument, by Johann III, was completed in 1632.

The SCHERER family's most prominent members were Jakob, who took over Jakob Iversand's (fl. 1507–37) business, his son Hans (the elder), and grandson Hans (the younger). Each Scherer was involved with at least one instrument of historical importance. Jakob Scherer added a Rückpositiv to the 1475–77 J. Stephani "Totentanzkapelle" organ at Lübeck, Marienkirche (1557–58; 2/25). The Totentanz organ was repaired by Henning Kröger (fl. 1613–22) in 1621, but destroyed during bombing in 1942; recordings from the 1930s have survived. Hans Scherer the elder built an instrument at Stendal, St. Marien (1580) that Praetorius describes in detail. Hans Scherer the younger built an organ for Tangermünde, St. Stephankirche (1623–24, 3/32); since its restoration (Schuke, 1994), this instrument is considered the "oldest playable organ in the Netherlands" and is heard in many recordings.

Two Scherer apprentices who later founded their own workshops were Johann Lange (1543–1616) and Anthonius Wilde (fl. 1593–99). Lange, who worked in Hamburg and (after 1578) Kamenz, later taught Gottfried FRITZSCHE, who helped establish the north German Baroque style on which Schnitger based his work. Wilde, a pupil of Hans the Elder, is best-known for an instrument at Lüdingworth (now Cuxhaven, Lower Saxony), St. Jacobi (1598–99; 2/19). Schnitger rebuilt this organ using much of Wilde's pipework, case, and windchests (1682–83; rest. Ahrend, 1981–82).

The Compenius family, associated with the Becks, was prominent in the latter sixteenth and first part of the seventeenth centuries. Compenius family members worked in Halle, Magdeburg, Nordhausen, and Würzburg, and were very consistent in its specifications, whether by preference or local taste. Esajas COMPENIUS, a colleague of Praetorius, built a chamber organ with wooden pipes at Hesse Castle (Brunswick, 1608–10; 2/27); it was moved to the Danish royal chapel at Frederiksborg Castle (1617); maintained in its original state, it has been used in recordings. Heinrich the younger built a new instrument at Magdeburg Cathedral (1604–06; 2/42, three divisions; repl. A. Reubke, 1830); its specifications were also given by Praetorius. He also built an instrument for Halle, St. Moritz, with the collaboration of Samuel Scheidt (1624; 2/26).

Daniel BADER, a pupil of the Brabantine builder Arendt (Arnold) Lampeler van Mill, worked primarily in Belgium, but rebuilt (1612) a Lampeler van Mill instrument (Münster, St. Paulus-Dom, 1588), built to replace a 1536 organ, itself built to replace yet another that had been destroyed by Anabaptists in 1534. Bader's son Arnold repaired the 1588/1612 instrument in 1624.

Some of the earliest German organ music was written down in the fifteenth century. The notation system, TABLATURE, directed the action to be taken by the player by indicating the location of keys within a particular octave (using numbers or letters). There were a number of variants on this principle, which was used in some form (albeit decreasingly) until the mid-eighteenth century. The major German publication of organ music during the fifteenth century was contained within the *Fundamentum organisandi* of Conrad Paumann (Nürnberg, 1452), a handbook on keyboard improvisation (right hand) above slow (cantus firmus) melodies based on popular songs (left hand). Paumann also left a few of these improvisations, or intabulations, in manuscript; based on popular (often monophonic) songs. This type of piece later became closer to a modern-day transcription or arrangement: transferring a piece meant for an instrument, voice, or combination thereof to another instrument, with any vocal part incorporated. Other organ manuscript collections include the tablature of Ludolf Bödeker (ca. 1450), the anonymous Lochamer Liederbuch (songbook, 1452–56), and the Buxheimer Orgelbuch (ca. 1470); the latter contains transcriptions of works by Gilles Binchois, Guillaume Dufay, John Dunstable, and Conrad Paumann. The music attributed to the monk Adam Ileborogh (ca. 1448) uses fragments of sacred melodies in the left hand (or pedalboard) bass, accompanying an unpredictable yet meditative right-hand part. Manuscripts of German intabulations of vocal music proliferated in the sixteenth century, including the *Tablature of Celle* (1601), a collection of early organ chorales. Several tablatures are identified by their compiler, usually included as a composer: Hans Kotter and others (1513–32), Leonhard Kleber (1520–24, with pieces for MANUALITER only included); and Hans Buchner (1530).

Schlick followed up on his *Spiegel der Orgelmacher* with *Tablatur etlicher Lobgesang* (Mainz, 1512), based on hymns rather than secular songs. Elias Nicolaus Ammerich, longtime organist at the Thomaskirche in Leipzig, published two collections in Nürnberg: *Orgel oder Instrument Tabulatur* (1571) and *Ein new künstlich Tabulaturbuch* (1575). Others who published collections include Bernhard Schmid (1576, 1607), Jakob Paix (1589), Johannes Rühling (1589), and Michael Praetorius (1609, 1611). Additional German composers of important organ music include Heinrich Finck, Hans Leo Hassler, Michael Praetorius' father Jacob, and Hieronymus Praetorius (no relation).

Theological Battles

As the European center of Renaissance Christianity, Germany bore the brunt of the religious upheaval of the sixteenth century; organ building was affected far more dramatically than during the squabbles of the medieval church. In 1521 (the year of his excommunication from the Roman Church), Martin Luther criticized the use and building of organs (and many other items) as an inappropriate (i.e., "papist") form of worship and a waste of money; he did not encourage their destruction, however. A Thuringian, Luther loved music for its own sake and as God's "excellent gift," wrote often on the subject, and composed or adapted melodies to appropriate chorale texts, publishing several hymnals (1525–1545) during his lifetime. At first, Lutheran congregations (and the occasional choir) sang a cappella; later in the century, the organ began to appear in the service, playing intabulations of chorales and other pieces as introductions or interludes. The ALTERNATIM structure became increasingly popular. By 1604, the addition of a continuo (figured bass) line to the chorales in a Hamburg hymnal indicated the full incorporation of instrumental playing in Lutheran practice, culminating in the Baroque cantatas of Johann Sebastian Bach and others.

Luther could not control the more extreme responses to Roman practices by some of his contemporaries. In Zurich, Ulrich Zwingli, pushing for an evangelical city free of papal authority (1523–24), interpreted the Bible literally, banning choral singing and keeping organs out of churches (1526–27). Two former Zwingli allies formed the Anabaptists in 1525; wishing to eliminate all secular or religious authority, some Anabaptists attempted to establish a stronghold of their own in

Münster in 1535, taking the opportunity to destroy organs and other "popery" in its churches; they paid dearly for their radicalism.

The final significant "antimusical" impulse came from John Calvin. Invited by the newly Protestant city of Geneva to establish a "reformed" church, his initial efforts lasted only three years (1535–38). Expelled, Calvin moved to Strasbourg and wrote *The Institutions of the Christian Church*. Invited back to Geneva in 1540, he established a government based on his interpretations of the Bible. Going Zwingli one better, Calvin banned all singing of hymns in church. Only the performance of the psalms in syllabic homophony (a chordal style, with the melody in the highest voice) was acceptable. Instruments, of course, were nowhere in sight. Calvinism gradually became the most widespread form of Protestantism, the point of departure for the British Commonwealth (1649–60) and the Separatist Puritans who landed at Plymouth Rock (1620). Organs would not appear in any Reformed churches until the latter seventeenth century (in the Netherlands, where they had been banned entirely a century before) and in other churches until the nineteenth century.

The Counter-Reformation of what became known as the Roman Catholic Church was defined by the Council of Trent (1545–63), and decisions regarding music were included in a papal decree (Pius IV, 1562). Association of singing or organ playing with "anything lascivious or impure, as well as also all secular actions" was banned. While the council's primary musical association is historically with Giovanni Pierluigi da Palestrina, the tacit permission given to organ playing (in an accompanying role) to continue affirmed the church's longstanding relationship with the instrument, the pure enjoyment of organ sounds by much of the ecclesiastical company, and the desire not to emulate the more destructive tendencies of the Reformation.

The Low Countries

The area now occupied by the Netherlands, Belgium, and Luxembourg was for centuries a political football, in turn occupied by the Holy Roman Empire (under Frankish rule), part of the kingdom of Lotharingia (Lorraine) by the late tenth century, and separated into independent duchies in the twelfth century (including Holland, Flanders, and Brabant, a border region and future crucible for organ building). By the fifteenth century the entire region became part of the duchy of Burgundy, which was inherited by the Hapsburgs later that century. In 1516, the Hapsburgs ascended the Spanish throne; Spain now gained control of the region. The northern (Protestant) provinces unified and declared independence from Spain (1581), which they were finally given in 1648. The "Spanish Netherlands," the southern Catholic provinces, remained part of Spain, although part of the area was annexed to France by Louis XIV; Belgium did not become a sovereign kingdom until 1839.

The fluidity of the area politically was matched to some degree by the travels of organbuilders. During the latter fifteenth and sixteenth centuries, the Netherlands and Belgium were a unit under Hapsburg rule; only with the northern (Dutch) challenge to Spain late in the sixteenth century was that unity disrupted, a process not completed until well into the seventeenth century. Commerce flowed freely between the provinces, with several cities becoming important European trade centers (and therefore able to sponsor considerable organ building). To a certain extent, German builders were brought in to work, often staying long enough to have their German names turned into Dutch or Flemish (e.g., Hans Suisse).

Despite the orthographical havoc there, those who commissioned organs in the Low Countries were the beneficiaries. Their builders, particularly those located in the former duchy of Brabant (both Belgium and the Netherlands have a modern province of that name), were valued for their pipemaking skills and tonal experimentation. German-born builders were in the forefront of the breakdown of the Blockwerk, and their divisions and mixtures attained a high point of sophistication. The cross-fertilization of ideas, not only from apprenticeship and collaboration but observation and discussion, was vitally important to an area in which the number of excellent organs was out of proportion with its small size and population, especially when compared to Germany, its southern neighbor, France, and its colonial master, Spain.

In the Low Countries as in Germany, case construction and placement of divisions reached a classic stage, prior to the Baroque taste for a high degree of visual elaboration. Building from the keyboard, the *Hoofdwerk* rested on a horizontal base. The facade was divided into towers (located centrally and at either extreme) alternating with flats that held two layers of pipes. The larger the instrument, the more towers with "interwoven" flats it would have (e.g., four towers plus three flats, including a central flat above the console). The *Bovenwerk* division would be placed over the central grouping of towers and flats. The *Borstwerk* was a small division, placed above the console area and below the Hoofdwerk chest; its purpose was inconsistent, sometimes functioning as a Regal, other times as an incorporated Rugpositief, but often as a SOLO division taking some of the more effective "color" stops from the Hoofdwerk. When used, the Rugpositief fulfilled its traditional role as a chair organ behind the performer.

Like others, members of the first important organbuilding family in the "northern Netherlands" took a middle name based on paternity; Peter Gerritsz, as he is known, would have been named Peter Gerritszoon, followed by a surname (unknown). Peter Gerritsz built two instruments for Utrecht's Nicolaikerk; the first was moved to the Koorkerk in Middelburg (1479–80, 3/41; extant, needs restoration); Peter's relative Cornelis Gerritsz built an organ for Amersfoort, St. George (1551; 3/24, pull-down ped; dism. 1844). The claim that Cornelis was Peter's son is problematic; he may have been Peter's grandson, son of an unknown son of Peter named Gerrits, or not related at all.

Another important builder, the German-born Hendrik (Heinrich) NIEHOFF, studied in Amsterdam with JAN VAN COVELENS; Niehoff kept his workshop in the Netherlands ('s Hertogenbosch from 1538 on) but did the bulk of his later work in Hamburg, the Rhine region, and Westphalia. Hans Suisse, Hendrik, and his brother Herman Niehoff built a large organ for the Oude Kerk, Amsterdam (1539; 3/27; Rugpositief and Bovenwerk each divided into two chests; dism. 1724); this instrument was used by Jan Pieterszoon Sweelinck. Hendrik, who built spring-chest organs and incorporated the Brabantine stops he had learned from his elders, enlarged a 1507 instrument at Hamburg, St. Petri (1548–50) by adding an Oberwerk (eight stops), a Rugpositief (eleven stops), and a Pedal (eight stops) to the sole Hoofdwerk stop (a 16' Grossmixtur, i.e., Blockwerk; final total, 3/28); this organ, subsequently renovated by the Scherers, Fritzsche, and Schnitger, was destroyed by fire (1842). Henrik's son Nikolaus worked with Arent Lampeler van Mill (fl. 1573–before 1590), who came from Brabant. Lampeler van Mill built an "altar positive" for St. Michaëlskerk, Zwolle (1566), then built cathedral organs for Cologne (1573, three manuals) and Münster (1585–88). He began work on an organ for Münster, St. Ludgeri; it was completed by his son Reinhard (1590, fourteen stops; destr. 1945). Reinhard had better luck with his instrument for Bern, St. Aegidus (1593–96); rebuilt many times, it was restored in 1996. Peter Janszoon de SWART of Utrecht built an organ for Amersfoort, Notre Dame (1573, 2/15; still in use in 1774, it was lost thirteen years later when an explosion in the church, by then an ammunition warehouse, destroyed the instrument.

In Belgium (Flanders; the "southern" Netherlands), Daniel van der DISTELEN established a model for a three-manual organ with an instrument, destined for a chapel in Antwerp Cathedral; it comprised a Hoofdwerk, a Rugpositief, and a "positive set in the breast of the main organ" (Borstwerk), the first delineation of a third division (1505, 3/19). Distelen also built a small organ for Worms, St. Andreaskirche (1510, 1/11). The LANGHEDUL family was the first Netherlandish dynasty to develop an international reputation, especially in Paris. Active from around 1475 to 1635, several family members were working abroad by the latter sixteenth century. Jan Langhedul, who lived in France (1583–90), built two smaller organs for Paris; the first, for the Augustine monastery (1586, 2/16) featured a Pedal of one reed (Saqueboute) and a one-stop Echo (Cornet VI). The second, even smaller, was for St.-Jacques-la Boucherie (1588, 1/12), again with a one-stop Pedal. Both instruments had characteristically French dispositions: Bourdon, Nazard, Trompete, and Clairon (the 1586 organ added a manual Cromorne). The use of the quiet ECHO division, located just above the console, would become a signature part of French and French-influenced organs. Guillaumes Langhedul built an instrument at Ghent, St. Bavo (1590; 2/21/no ped) with a one-stop RÉCIT (a solo Cornet IV), another harbinger of things to come in French organ building. The most widely traveled Langhedul, Mattijs (Jan's son), lived and worked in Spain (1592–99), then Paris (until 1605), before returning to Flanders. Two instruments illustrate something of his versatility (and adaptability): Paris, St.-Gervais (1601, 2/21; French disposition) and Antwerp, Cathedral, Brothers of the Holy Sacrament Chapel (1/10/no ped., more international disposition, with Nightingale, Drum, and Harp effects).

The Antwerp-based MOORS family was far more local in scope, although its youngest member, Anton the Younger, moved to northern Germany, bringing with him the refinement of Brabant tonal innovations to that region. For a short time, an instrument of his stood in Mechelen, Our Lady of the Dyle River (ca. 1550). The remarkable Gilles (Gillis) BREBOS, who began his career in the Antwerp region, soon replaced the Moors organ at Mechelen (1565), and built a new instrument for Antwerp, Notre Dame (1565–67, two manuals), advised by John Bull. Brebos and his family were even more influential than the Langheduls in spreading the Flemish style throughout Europe. In 1570–71, Gilles traveled to Italy; unlike many other Flemish musicians who moved there permanently, it seems to have been a study trip only, and he soon returned to Flanders. But in 1578, he moved with his three sons, Gaspar, Michiel, and Jan, to Spain, where they were commissioned to build four organs for the royal monastery at El Escorial by Philip II. Gilles died before the job was completed (1584), but his sons finished the task.

Organ music in the late Netherlandish Renaissance is as powerfully associated with Sweelinck as late German Baroque organ music is with Bach. But unlike Bach's predecessors, the works of Netherlandish organ composers before Sweelinck have either not survived or remain obscure. One exception is Pieter Cornet, a Brabantine who served as organist at the royal chapel in Brussels; his surviving fantasias are notable for their virtuosity, more spontaneous when compared to the music of Sweelinck.

France

Although the identity of modern Catholic France is quite clear, this was not the case in the past. Originally part of the Merovingian and Carolingian kingdoms, the area was divided into several duchies. After the Norman conquest, much of northern France was subject to English domination, a condition the reversal of which was completed only in 1558. Shortly thereafter, religious civil wars erupted, ended by the Treaty of Nantes (1598), which dictated tolerance of Protestantism. (Louis XIV revoked the edict in 1685, leading to an exodus by the Huguenots.)

Historically, the duchy of Flanders had become a dependency of France after the breakup of the Lotharingian kingdom in the twelfth century. After the Burgundian and Hapsburg successions, the future Belgium had become part of the Spanish Netherlands. When the northern provinces revolted in 1579, the southern provinces remained part of the Hapsburg territories. The dominance of Roman Catholicism in that region had established ongoing connections with France and Spain; by the end of the Renaissance, many organs in France had been built by Flemish builders.

There were other French regions where foreign influence (and ferment) occurred naturally: Alsace, and, to a lesser degree, Lorraine. Both areas were part of the Holy Roman Empire and divided into principalities during the medieval and Renaissance eras. For centuries, Alsace was the subject of contention between the Hohenstauffen, Burgundian, Hapsburg, and French rulers. In the thirteenth century, Alsace became a union of ten imperial cities under the Holy Roman Empire, with considerable commercial success due to its strategic location near the Rhine, Rhône, and Marne rivers and along major north-south and east-west trading routes. The region, especially Strasbourg, its capital, became a hotbed of Protestantism; Martin Luther, John Calvin, and other reformers sought refuge there. One city, Mulhouse, even joined Switzerland in 1515, returning to France only after the Revolution. Alsace was also a battlefield during the Peasants' War (1524–25). Alsace was devastated by the never-ending invasions of the Thirty Years' War (1618–48), and was eventually taken over by the French under Louis XIV. Despite bouncing between France and Germany in the centuries since, Alsace was a Germanic territory (Elsass) during the period under discussion, as often reflected in the names of the builders who worked there.

The overall trends in French organ building of the period have already been alluded to. French leanings toward the Echo and Récit divisions were sufficient for Flemish builders to adapt their dispositions accordingly. Other preferences included a greater use of reed stops, more mutation stops (beginning with the Tierce), and a less imposing, more melodic Pedal division than German and Dutch organs. The GRAND JEU featured some of the most dramatic reed stops, including the Cornet, the Tierces, and the Prestants that projected their sound directly to the congregation. The less brilliant Plein jeu focused on octave Principal stops and the Fourniture. Neither mixture required an excessive amount of wind. A characteristic (perhaps surprising at first) of French organ building was its striving toward a predictability of disposition, allowing composers and organists to produce the desired sonorities, rather than force an organist to invent a REGISTRATION that might run counter to the composer's intentions. While the only freedom left would seem to have been registrations for improvisation (always an organist's play- and at times proving-ground), organ scores were rarely marked explicitly until the Romantic period. and the quality or condition of the instrument itself.

Thanks to Albert SCHWEITZER and the so-called Alsatian Reform Movement of the early twentieth century, Alsatian organs and their builders have been well-researched. One example, the main organ at Strasbourg, Notre Dame Cathedral, demonstrates the extensive history one location could have: Ginzelin von Frankfurt (1292; destr. 1298), Claus Carlen (1327; rep. C. von Rothenburg, 1378; destr. 1384), an anonymous builder (1385; now a swallow's nest), Gerlach Gerais (1434), and Friedrich Krebs (1492) had all contributed to the cathedral by the fifteenth century alone. Hans Suisse built his instrument into the Krebs case (parts of which dated back to 1385), using sliders (1511). The cathedral became a Protestant house of worship (1521). Johannes Schentzer repaired it in 1542, followed by Sigmund Peistle of Gribourg-en-Brisgau (1564); Anton Neuknecht finally enlarged the Suisse organ (1608; 3/21), retaining the Krebs case. The organ was renovated several more times. The church returned to Roman Catholicism (1681). Andreas SILBERMANN rebuilt the organ (1713–16). After being dismantled in 1908, the organ was resurrected in 1927, albeit in very different form. The most recent rebuild (Alfred Kern, 1981) took the remaining pipes of the Silbermann organ (and the Krebs case) to create an amalgam of more than five hundred years' worth of builder activity.

Renaissance Alsatian builders included Ruppert Eckstetter from Constance, who contributed instruments to Ribeauvillé (ca. 1500) and Kaysersberg (1525); and Matthias Kern (d. 1507), who worked in Strasbourg and Obernai as well as Basel. A loose confederation between Alsatian and Swiss Protestants resulted in the free movement of builders between the regions. Hans Tügi (ca. 1460–1519) worked in Basel from 1487 and was considered a major figure in a town that had more than its share of builders. Two organs he built were lost during the religious civil wars: an instrument for Colmar, St. Martin (1513; dism. 1576), and a swallow's nest organ for the municipal church of Biel (1517; 2/9; destr. 1527; reconstr. Metzler, 1994).

Late Alsatian builders included Anton Meutting of Augsburg (Strasbourg, St.-Pierre-le-Vieux, 1590) and Hans Klein of Donauwörth (Strasbourg, St.-Pierre-le-Jeune, 1591). Three Swiss-born builders active in Alsace were Hans Werner Mudderer of Fribourg (fl. 1594; d. after 1621; Colmar, Unterlinden Convent, 1594); Hans Huodt (fl. 1592–1619), whose workshop was in Fribourg but who worked mostly in Alsace (Riquewihr, Ste. Marguerite, 1609; dism. 1758); and Thomas Schott of Bremgarten (Lucelle Abbey, 1615; eighteen stops; destr. 1638).

Moving to north-central France, the history of the Chartres Cathedral organ is almost as complicated as the cathedral's windows are beautiful. The first organ was commissioned in 1349; in 1452, Jean Bourdon repaired and restored it. A monk, Gombault Rogerie, received a contract to rebuild the one-manual instrument (1475). In 1482, J. Gautier, dit Le Marays, added a one-manual *Positif de dos* (Rückpositiv) with two stops, repaired the bellows, and tuned the entire instrument. Robert Filleul supervised a rebuilding of the Grand Orgue (1542–46), expanding the organ to two manuals and building a new case into the "balustrade" of Rogerie's 1475 rebuild. A committee (including well-reputed builder François des Oliviers) assessed Filleul's work in October 1546. Guillaume LEFÈVRE repaired the organ in 1581; Roch D'ARGILLIÈRES restored and rebuilt its pipes in 1598; and Crespin CARLIER did a thorough rebuilding in 1614–15. This fourteenth-century instrument, having survived neglect, fire, the Revolution and its aftermath, the Franco-Prussian War, and two world wars, was finally replaced by a neoclassical instrument in 1969, but its case is a national monument and survives.

To the southwest, the Angers Cathedral organ is almost as old as Chartres's, but with a far more eventful history. Records of organists date from 1367; in 1417, Jean Chabenbel built a new instrument. Lightning struck the cathedral towers in July 1451, destroying the organ. Ponthus Jousseline built a new organ (1507–12); the instrument had a *Positif de dos* and two towers with 32' pipes. Another fire (October 1533) burned down this organ; a new instrument (by Pierre Bert; La Ferté-Bernard, Notre Dame des Marais; reb. Renaud-Menoret, 1986) was commissioned immediately; when completed, it had three manuals and twenty-nine stops. After yet another fire destroyed the Bert organ (May 1617), Jacques Girardet built "one of the best organs in France," with forty-seven stops (including a Voix Humaine and Cornets), bells, "et plusieurs autres merveilles." A pedalboard was finally added in 1701; the organ endured the Revolution and survives in the total rebuild by Aristide CAVAILLÉ-COLL (1869–74).

In addition to the builders already mentioned, the PESCHEUR family was active in Paris in the latter part of the sixteenth and early seventeenth centuries. Valéran DE HÉMAN and Nicolas Pescheur taught organ building to the latter's son, Pierre Pescheur II; he rebuilt instruments at the Amiens Cathedral (1620) and Paris, St.-Gervais, and is best known for a new instrument at Paris, St. Etienne-du-Mont (1631–36; 4/30; pedalboard of thirty-two notes). De Héman, who married Carlier's daughter, restored the 1402 Fréderic Schambantz instrument at Paris, Notre Dame (1608–10), built instruments for Bordeaux, Cathédrale St.-André (destroyed during the Revolution) and Meaux, Cathédrale Saint-Etienne (1627), and worked on the sixteenth-century organ at Paris, St. Séverin (1627). One of De Héman's apprentices included Pierre THIERRY, first of an important family of Parisian builders whose son Alexandre worked with Robert CLIQUOT and whose grandson François Thierry had Andreas Silbermann as an apprentice (1704–06).

Some organ music of Renaissance French composers has survived (although the lute was the secular instrument of choice at this time). The compilations of Pierre Attaingnant, who published seven books of keyboard tablatures (Paris, 1530–31), include numerous transcriptions of motets and chansons, dances, preludes, organ masses, and Magnificat settings, thereby preserving the core repertory of Renaissance secular organ music in France. Eustache du Caurroy served as composer to the royal chamber for three French kings; he published a collection of forty-two instrumental fantasias in 1611. Jean Titelouze was born in the Netherlands but worked in Rouen from 1585, and later collaborated with Carlier on building a new organ. Titelouze was the great organ composer of the French Renaissance, publishing organ hymns and Magnificats as well as fugues. His conservative style represented the end of an era; the first flowering of French Baroque keyboard music (including the Couperins) would begin around the time of Titelouze's death (1633).

Spain and Portugal

The Iberian Peninsula was a major center for organ building, with considerable support from the royal families, nobility, and the very powerful Catholic Church. Much of the period was spent in expelling the Islamic Moorish population, as well as repressing Jewish and other "outsider" faiths, with the Inquisition as an effective weapon. The success of Christopher Columbus's westward explorations led both Spain and Portugal to start the process of "discovering" foreign territory and bringing it under their wings. The resulting self-confidence expressed itself in the building of ever more glorious cathedrals and churches; the later Iberian Baroque style was probably the most spectacular in Europe, especially with its copious use of precious metals.

The disposition of most Iberian organs was based on the Low Countries style, and many builders from the north worked on organs there during the sixteenth century. The most famous was the Brebos family, working for Philip II, who commissioned them to build four organs for the royal monastery at El Escorial. Gilles Brebos died before the job was completed (1584), but his sons finished the task. All four organs remain playable; they have been altered over the years, and can now be played together from one keyboard. One of the two large instruments rests in the priory choir (2/35); of the two smaller organs, a positive (1/8), was restored in 1998.

Certain characteristics became signatures of the Iberian organ. Most obvious was the use of regal or EN CHAMADE REEDS, in which horizontally laid pipes were gathered to form miniature, uncased "divisions" extending out from the case of a gallery organ. The stops themselves had colorful names, such as "marine trumpets," "royal trumpets," and "angels and seraphim," in which (sometimes animated) statues appeared to be blowing into sounding rather than dummy pipes. Besides the visual impact, there were other advantages to the en chamade pipe: powerful sonority, easy tuning and cleaning, and the replacement of cathedral trumpeters.

The distinctiveness of Iberian organs is perhaps clearest when compared to those of other nations. Most Iberian organs did not use a Rückpositiv, although many had their version of the new French Echo or Solo division. Like French organs, there were limited-compass Pedal divisions and suspended action. Slider-chests were the norm. Iberian instruments were unpredictable in their use of mutations; some dispositions resemble the French style, while others look like carefully divided Blockwerks with few nonoctave stops, echoing the most conservative German builders of the late Renaissance. A very old-fashioned element was the common use of a pull-down pedalboard. But by the seventeenth century, along with the pipes *en chamada*, the Iberian organ's "golden age" was based increasingly on visual appeal, even grandiosity, for its "success." The complex arrangements of towers, flats, and other case designs became as important as the pipechests themselves, and dummy flats were integral to the facades. While there are strong hints of this tendency during the Renaissance, the flowering of this approach was still to come.

There is a relative lack of information on specific instruments of the period in Spain, but the names of five organ-building dynasties are known: the Córdoba family, active in Saragossa (fl. 1504–1609); the Lupe family, originally from France, active in Tarazona, from Guillaume (ca. 1540–1607) to Gaudioso (1575–1622); Gaspar Marín (ca. 1540–1600), who worked in Rioja, and his son, Manuel (ca. 1575–1630), who spent most of his life in Valladolid and became one of the more notable builders of his time; the Mofferiz family, of Moorish background, active in sixteenth-ccntury Mahoma; Gabriel Mofferiz (d. 1573) built harpsichords and the first Iberian claviorgan; and the Puche (Puig) family: Tomás (fl. 1550), active in Saragossa; Cosme (relationship unknown), in Alfajarín; and Juan (b. ca. 1550, fl. 1584–87) and Miguel (active in Toledo, 1649–63, d. ca. 1688).

While knowledge of Portuguese builders is even scarcer in this period than in Spain, one individual has been relatively well-documented. Heitor LOBO has been credited with seven organs, including two at the cathedral in Porto (1537–38, replaced eighteenth century) and several monastic instruments. His style seems to have been more Italianate in spirit. An organ in the cathedral of Évora (1562; 1/9, with four open Pedal pipes), attributed to him on various grounds, includes a Voz Humana, a 2-2/3' mutation, and three mixtures; the addition of one *en chamada* reed proved irresistible in the eighteenth century, but otherwise the disposition is original. This is one of the few surviving Portuguese organs of the sixteenth century.

The Iberian Renaissance was one of musical history's high points. One of the greatest schools of keyboard music was in flower, ahead of other national schools. While there are two major manuscripts of organ music now held at Coimbra, Portugal (ca. 1560; ca. 1570), most important Iberian keyboard music was published, unlike in other countries. Another regional characteristic was the publication of didactic treatises on keyboard music. Juan Bermudo published *Declaracion de instrumentos musicales* in 1555; ten years later, Tomás de Santa María published *Arte de taner fantasia, assi para tecla como para vihuela, y todo instrumento*. Both describe playing technique, especially fingering, and the art of ornamentation (i.e., composition); imitative (fuguelike) pieces, grouped in pairs, are given as examples. In his treatise, Bermudo informs his readers that it will take them twenty years to master the instrument. Santa María preferred not to discourage his readers; consulting with highly respected organists Antonio and Juan de Cabezón, he produced a wider-ranging survey, taking two books to cover Gregorian chant, harmony, counterpoint, notation, and performance practice. The Castilian Diego Ortiz published his *Tratado de glosas*, teaching ornamentation and improvisational practice for viol (string), in 1553. Ortiz writes out parts in open score, giving each part its own staff, rather than the two- or three-staff norm for keyboard music today; this system was far easier than learning a piece from separate choir books. Finally, the organist Francisco Salinas published his *De musica libri septem* (1577); he apparently built a keyboard with SUBSEMITONES that impressed his contemporaries greatly. Luys Venegas de Henestrosa published a volume of keyboard music, the *Libro de cifra nueva para tecla, arpa y vihuela*, in 1557, including works by the blind organist Antonio de Cabezón, the greatest composer of Spanish Baroque instrumental music. Most of Cabezón's works were first printed posthumously by Hernando de Cabezón (either his son or nephew) as *Obras de musica para tecla, arpa y vihuela* (1578), with a summary of Antonio's views on keyboard playing.

The Lisbon earthquake of 1755 destroyed the royal library, containing a large portion of printed or manuscript organ music collections. In Spain, among the notable losses were the works of Francisco de Peraza, apparently much in demand during his brief lifespan; his works—keyboard pieces, secular and sacred vocal music, and theater music—is almost entirely lost. Whether through natural disasters, fires, or replacement, many older Iberian organs were destroyed, often along with their churches.

Italy

Italy developed organ-building traditions that, while not immune to foreign influences, changed relatively little during the late medieval and Renaissance periods, except by builders' own initiative. The sophisticated simplicity of Italian instruments came about for reasons beyond aesthetic pleasure and friendly competition. Even more than Renaissance Germany, "Italy" was a concept that had as yet no great nationalist ring. Virtually every major Italian city had its own ruler, and nothing prevented them from making and breaking alliances at will. Rulers came to see the sociopolitical power of humanism (simmering since classical Greek and Roman texts had become more available during the medieval period) as a source of pride and, more important, wealth. The best and the brightest artists were summoned to noble courts to ply their trades. Another factor was the presence of the center of the Roman (later Roman Catholic) Church. This era proved as enriching economically for the church as it was for the most successful members of the new merchant class, which supported both royal courts and church. While the erecting of houses of worship went on enthusiastically elsewhere, the finances for Italian churches were supplied by religious and municipal authorities to a degree found virtually nowhere else in Europe. Once the church had accepted the organ as a viable means of praising God, the presence of a good instrument became a necessity.

In essence, the Italian organ did not experience the kind of breakdown of the Blockwerk and the resulting expansion of organ sonority that occurred throughout the rest of the Continent. Almost all Italian instruments were limited to one manual, a characteristic of the Italian organ long after the turn of the seventeenth century. Some instruments had pull-down pedals, occasionally with a 16' stop added, but a second manual was a rarity. To compensate for this, there were more Principale stops on that single manual than in most Continental schemes of the period. These stops were named according to interval; the stop two octaves above the Principale 8' was the Quintadecima (fifteenth), a fifth above that the Decimanona (nineteenth), and so on. As a group, these constituted the main chorus, or RIPIENO; this was the basis of the Italian *organo pleno*. Mutation stops were infrequent—for example, the seventeenth or Tierce (1-3/5'), usually called the Cornetto. Each stop tended to have only one or at most two ranks of pipes.

Unusually long manual compasses begin to appear in Italian keyboards in the mid-fifteenth century The average Continental keyboard of the period had thirty-eight or so keys (the 1539 Oude Kerk organ in Amsterdam has a maximum of forty-five manual or pedal keys), yet the 1473 Benricevuto di Leonardo organ at San Martino in Lucca already had fifty-three in its single manual. This suggests that such a manual could cover all available stops; fifteenth-century references to "registers" and "stops in the modern manner" suggest early Italian use of slider-chests to set stops off from one another. The Giacomo di Giovanni organ at Orvieto Cathedral had sliders and spring-stops by 1480.

As for acoustics, Italian builders took advantage of the smaller numbers of ranks and the single keyboard to construct simpler shapes than found to the north. In smaller instruments, pipes were placed in a rectangular chest so that the tallest were in the middle, the shortest at either extreme; a gentle arch rounded off the top of the chest. The empty chest space above the pipe provided an opportunity for blending sounds so that the ripieno was especially effective when projected. In larger organs, a five-chest case might comprise a towerlike bass chest in the center and a pair of smaller chests to either side, one above the other, all in a large rectangular structure. Compared to northern instruments, Italian cases were for the most part restrained.

Between contracts and pay records, documentation on Renaissance organbuilders is perhaps nowhere more impressive than in Italy. Records reveal building families and individuals, different degrees of mobility, and, in some cases, a considerable amount of attention paid to an organ (or organs) in one church: in the period leading up to 1600, there are thirty-two entries for the Duomo (S. Maria del Fiore) in Florence, twenty-five for the Duomo in Pisa, and twenty-one for Basilica di S. Pietro in Perugia. Another trend, the activity of foreign builders, is already apparent in the Leonhard of Salzburg organ at Padua, S. Giustina (1493), a one-manual, thirty-eight-key instrument with Tenori 8' (later Principale), Ottava 4', Decimaquinta 2' (Quintadecima), Decimanona 1-1/3', Vigesimaseconda 1', and Flauto 8' (the only non-ripieno stop).

The Romani family, based in Cortona, worked on the Duomo in Arezzo for over a century (1534–1640). During their overall period of activity (1533–1645), the seven members of that family worked on at least ninety-five different churches, especially in Arezzo, Florence, Perugia, and Volterra. Luca BLASI, from Valcaprara near Perugia, may have been the most active builder of the era, having worked on at least twenty-five instruments (most completed between 1582 and 1597); his primary sphere of activity was in Rome. His brother Stefano (d. 1631 in Rome) worked on some of the same churches as Luca, but in later years; his major work after his brother's death (ca. 1608) was at Rome, S. Maria in Aracoeli (1613, 1621–24). Blasi worked together with (and perhaps for) Vincenzo FULGENZI in Marche, where Fulgenzi spent most of his Italian career. A native of either France or Flanders (he is referred to as "Vincenzo Fiamengo"), Fulgenzi brought an expertise in reed stops that influenced many Italian builders. He is best-known for his work on two Umbrian cathedrals: S. Pietro in Gubbio (1582, 1587–89, with the Blasi brothers) and his rebuilding of the Duomo in Orvieto (1591–94). Three of his sons went into the trade; the last known Fulgenzi instrument dates from 1620.

The earliest significant Italian builders on record are Domenico da Siena (fl. 1372–88), who worked primarily in Florence, and Andrea di Giovanni (fl. 1388–1406), who worked in Florence, Pistoia, and Siena. The greatest individual builder of the fifteenth century was Lorenzo (di Jacopo) da PRATO, who spent most of his early career in his native Tuscany and Umbria. Prato also worked to the north, in Padua, Bologna, and Udine; his best-known instrument stands at Bologna, S. Petronio, where he built the so-called epistle organ (1471–75). He moved permanently to Naples (ca. 1480); all of his late work (except a 1490 visit to Orvieto) was completed in this city or its environs. Matteo di Paolo da Prato first repaired organs (early 1430s), then built at least one organ in Florence, Duomo, Chapel of the Annunciation (ca. 1444–53; reb. several times; dism. 1911). Any relationship to Lorenzo da Prato is undetermined.

The most successful builders during the northern Italian Renaissance were the ANTEGNATI family, originally from the Swiss border. Giovanni Antegnati established citizenship in Brescia (1436), now part of the Venetian Republic. A parade of organ-building Antegnati began with Giovanni's son Bartolomeo, who probably trained in Brescia and worked there, and in Bergamo and Milan, and Giovanni's two organ-building grandsons, Gian Battista Antegnati (b. 1500; Milan) and Gian Giacomo Antegnati (b. 1501), who created two family branches. Gian Battista, who built instruments at Brescia, Lodi, and Padua, was primarily an organist. Gian Giacomo was more active, working in Brescia, Milan (S. Maurizio al Monastero Maggiore, 1554, rest.), Salò, and Vivegano; his son Benedetto Antegnati worked in Brescia (Sant'Alessandro, 1563), Parma, Saronno, and Turin; his last instrument is dated 1578.

Gian Battista's son Graziadio Antegnati (b. 1525) was the greatest organbuilder in the family, placing instruments in Asola, Bergamo, Brescia, Cremona, Mantua, and Bellinzona, Switzerland (SS. Pietro e Stefano, Collegiata, 1588; 1/12; second manual Eco added 1810; rest. Mascioni, 1997–98). His son Costanzo Antegnati apprenticed under his father from at least 1565 on, and built instruments throughout northern Italy; but Costanzo eventually changed careers, becoming the cathedral organist in Brescia (1584–1624). He composed a group of organ ricercars that were included in *L'arte organica* (1608), a study of the family's building specifications and tuning practices. Costanzo's theories on registration are similar to French theories of the period, but with the characteristic ripieno. He describes the typical late Renaissance Italian organ, with one manual (thirty-eight or fifty keys), pull-down pedals, spring-chests, the 8' Principale and ripieno mixtures (the latter comprising Ottava, Quintadecima, and higher ranks), some DIVIDED STOPS, increasing use of the mechanical TREMULANT, and an unwillingness or inability to make reed stops, even when ordered. Costanzo's inventory of more than 140 instruments (the entire family's output comes to around 250) reinforces a characteristic that Italian builders of the later Renaissance and early Baroque shared with their French counterparts: a desire for predictability of registration and sonority, giving composers a good idea as to how a piece would sound on instruments by different builders at different locations.

Other important Italian builders and building families include (dates are of known activity): Matteo di Paolo (1421–65), Tommaso di Giovanni (1479–1513) Domenico di Lorenzo da Lucca (1479–1523), Piero di Matteo Dondi (1483–1517), Andrea di Nanni (1494–1523), Giovanni di Antonio Piffero (1506–69; Siena,

S. Maria della Scala, 1519; rest.), Giovanni Battista FACCHETTI; the Contini family (1529–1606), the Bacci family (1538–1622), Giovanni CIPRI (Bologna, S. Martino Maggiore, 1556; rest. Zanin. 1995); Onofrio Zefferini (1542–80), Baldasarre Malamini (1565–1618; Bologna, S. Petronio, gospel organ, 1595–97; rest.), Vincenzo Colonna (1577–1624), the Palmieri family (1582–1655), and Francesco Maria Galganetti (1588–1619). One important church needs mention: San Marco in Venice. In the sixteenth and early seventeenth centuries, Andrea Gabrieli, his nephew Giovanni, and other composer-organists worked there; the *concertato*, spatially divided chorus, double-ensemble style developed (anticipating the loud-soft, orchestra-soloist structure of the Baroque instrumental concerto and beyond). However, the organs played upon disappeared long ago, killed in equal measure by the elements and the new taste for Baroque grandeur (and its later manifestation, the Rococo) that gave cities like Venice their special charm.

Like Spain, medieval and especially Renaissance Italy were fertile ground for both vocal and instrumental composition; indeed, the two were bound up in one another, with transcriptions and intabulations the primary keyboard genres in Italy until the *canzona* ("song") and *sonata* ("sound piece") keyboard genres of the latter Renaissance. The most important keyboard manuscript, the Faenza codex, contains early fifteenth-century transcriptions of anonymous late fourteenth-century (i.e., medieval) songs. But once Italian printers such as Ottaviano Petrucci had learned how to apply movable type to music, Venetian and other composers found their way into print: Marc'Antonio Cavazzoni (1523) and his son Girolamo Cavazzoni (1543), Claudio Merulo (1567), the Flemish transplant Giovanni (Jean) de Macque (1586), his student Ascanio Mayone (1603), Adriano Banchieri (1591), Giovanni Paolo Cima (1602), Giovanni Maria Trabaci (1603), and Girolamo Diruta (*Il Transilvano dialogo sopra il vero modo di sonar Organi*, 1613, an manual with a small number of organ pieces), not to mention the important anthologies of the Venetian printers Andrea Antico da Montana (*Frottole intabulatae da sonare organe*, 1517) and Antonio Gardane (*Fantasie recercari contrapunti*, 1551).

More than 250 years of activity in Italy culminated and turned a corner with the music of the Ferrarese composer and organist Girolamo Frescobaldi, who, like Sweelinck in the Netherlands, summed up one era as he set the stage for the one to come. France and Germany lacked such transitional giants; France seems to have held its breath until Titelouze's death, while Germany would soon be wrapped up in too much religious controversy to worry about musical style. Both countries would learn much from seventeenth-century Italian music, but in 1600 this was still several decades in the future.

On the Periphery

Countries that bordered on Germany and France were heavily influenced by the style of those organ-building centers; other than Netherlandish builders, the reverse pattern seldom occurred. Denmark had had close ties with northern Germany for centuries; during this time, Schleswig (now German) was Danish. The fluid cultural nature of the border is embodied in the life and work of Nicolaus Maass, who was possibly born in Stralsund of (apparently) Dutch descent, active in Germany, then an émigré to Denmark, where he became royal organbuilder, and culminated his career with an organ for Frederiksborg Castle. In addition to Maass, Hermann Raphaëlis RODENSTEEN (Rottenstein-Pock, ca. 1510/20–1583) arrived in Denmark in 1550; he built organs for Roskilde Royal Cathedral (1554–55; rest. Marcussen, 1991) and the Copenhagen Castle chapel (1557). Rodensteen moved to Saxony and built an instrument for the Elector Augustus, son-in-law of Dorothea, Queen Mother of Denmark; he may have built another organ for Dorothea's chapel at Sønderborg Castle (1568–70; rest. M. Kjersgaards, 1996). Both restored instruments are used actively in recording. The major figure between Rodensteen and Maas was Hans BREBUS, who went in Denmark (by 1569) and was appointed royal organbuilder the following year. He built instruments for churches in Denmark—including Helsingør (contract, 1570), Kronborg, Slotskirche (1582), Næstved (St. Peter, 1583–86; case survives), Vordingborg (1587), and Nyborg (1588)—as well as Danish cities now part of Sweden: Torrlosa (1580), Malmø (1588), and Marstrand (?1598 or 1603/04; 1/9; rest. 2000; now in Morlanda).

Little is known about organ building in what is now Eastern Europe. The best-known Polish builder of the early Baroque, Jerzy Nitrowski, apprenticed with Hans Hummel, a Cracow builder of German descent. Nitrowski completed two instruments Hummel left unfinished, in Olkusz (1611) and Levoča (1624–30). Nitrowski went on to establish an important family firm involving both his sons. Prague was often under the influence of German-speaking nations. A 1670 contract for Our Lady on the Týn states that a new instrument was to replace a 1573 organ by Albrecht Rudner, of uncertain origin and otherwise obscure. In Latvia, under German domination from the thirteenth- to the mid-sixteenth centuries, there was an organ at Riga, Katharinenkirche, as early as 1392. Balthasar Zinnecken built a new instrument for Riga, Petrikirche (1520). Finally, the organ at Riga Cathedral was destroyed by fire in 1547; in 1601, Jakob Rabe of Lübeck built a new instrument with three manuals and a pedal. The Russian kingdom, tied to the Orthodox Church's ban on the use of instruments in worship, had no history of organ building until later in the seventeenth century, when Polish builders were brought in to do the work.

Austria borders on southern Germany; with a history of linguistic and political connections and changing borders, cultural relations have remained strong. In the organ-building world, two names stand out. The Hayl family was originally from Swabia (Germany); early in the sixteenth century, the third (?) generation of Daniel the Younger (ca. 1590–after 1640) and Simon (ca. 1590–after 1642) divided their operation, with Daniel moving to Salzburg (to work in the Tirol) and Simon to upper Bavaria (on the Austrian border). Johannes (Hans) Wöckherl (d. 1660) was active in Vienna from 1607. His organ in the Franciscan church (1642; 2/20; reb. Rieger, 1980; 3/32) apparently had split keys. Wöckherl's pipework was considered on a par with those of van Covelens.

There are significant sixteenth-century tablatures from Swiss and Polish compilers. The manuscripts of Fridolin Sicher, organist at St. Gall (1525), and Clemens Hör (1535) contain intabulations; Sicher adds settings based on cantus firmus melodies. Jan z Lublina compiled his tablature over a period of more than a decade (1537 to 1548); his massive collection includes transcriptions, improvisations, and intabulations of vocal works by Europe's best-known composers as well as works by Polish composers. The Austrian organist Paul Hofhaimer was famous in his day; in addition to consulting on organ-building projects, he wrote keyboard works that survive in tablatures, but did not publish the music himself.

The British Isles

This survey ends with Britain, at the forefront of medieval organ building. As discussed above, Blockwerk-type instruments were built at cathedrals and monasteries, to the extent that organs in medieval England became something of an everyday thing, not worthy of special attention; they did not last in the cloudy, humid weather of the British Isles. From the fourteenth century on, church, municipal, and royal records of purchases and payments are the available documents; fortunately, the Domesday census of 1086 had taught Britons to record everything. Even with ongoing threats from the Celts, the French (as opposed to the Normans, who assimilated quickly), or from within, the British kingdom experienced itself as a national entity long before most of the continent, thanks in part to the body of water separating the two regions. With that separation came insularity, however. There was limited mobility for British tradespeople to ply their crafts on the Continent, and vice versa. There were a few exceptions in the organ-building world: the Scotsman William Leslie's transformation into Guillaume Lesselier, *facteur d'orgues*, in the early seventeenth century, circumstantial evidence of a Dutch builder (John Roose) working in York in 1457, and a Flemish organ in Louth (ca. 1500).

The oldest surviving organ case, at Old Radnor, Powys, Wales, dates from the early sixteenth century. But the religious strife that tore central Europe apart reared its head in England long before the German Reformation had begun. Henry VIII's dismantling of monasteries (ordered 1536) began the process of the decline of the organ; by the last quarter of the seventeenth century, the Calvin-influenced Anglican church-going population under Elizabeth I had become indifferent, even hostile toward such "lavish" symbols of the Roman Catholic Church. (Such feelings were no doubt encouraged by the struggles with Mary, Queen of Scots, and the Spanish Armada.) Deterioration due to neglect, combined with the destructiveness of the civil war that culminated in the Commonwealth, doomed the British organ; few instruments survived that era, and then only under special circumstances. The effect was to delay the closure of the English Renaissance until the Restoration, which provided the opportunity to create a genuinely British school of builders, albeit one heavily influenced by Germans who settled in England ("Father" Bernard SMITH) or Breton-born recusant Englishmen bringing French influences (Renatus HARRIS). It did not take too long before the British were in turn doing the teaching, to their colonists on the other side of the pond.

Surviving descriptions of instruments in Renaissance England point to a single-manual instrument of, at most, six stops; the instruments resembled large positives, possibly a precursor to the post-Restoration chamber organ with its domestic furniture overtones. While such instruments seem almost Italianate in dimension, there is no evidence of direct influence from the Mediterranean. Individual builders of the period include William Wotton (fl. 1486–89), who built instruments for Oxford University, and Anthony Duddyngton (fl. 1515–25), whose 1519 contract for All Hallow's Barking, London, commissions an instrument of three stops, tin pipes, and a four-octave manual. The Chappington family of South Molton, Devon, included Richard (fl. 1536–39), who built organs in Exeter and Woodbury; Hugh (fl. 1567–82), who built organs for churches in Salisbury (St. Edmund's, St. Thomas) and Braunton, Devon (St. Brannock's, 1569); John (fl. 1571–1597; d. 1606), best known for building an instrument for Westminster Abbey (1596–97); and Ralph (fl. 1611–19). In London, John Howe (d. 1571) collaborated on an instrument for Holy Trinity, Coventry (1526; 1/7; dism. 1570), and possibly one for Eton College (1531–32). He is associated with at least twenty-six instruments, mostly doing maintenance and repair.

The major figure in Renaissance England's organbuilding history was Thomas DALLAM of Warrington, Lancashire (ca. 1575–after 1629), the first member of a family that worked in England and Brittany into the eighteenth century (and married into the Harris family). Dallam's greatest claim to fame involves the mechanical organ he built as part of a clockworks, commissioned by Elizabeth I (ca. 1595) to be given to Mehmet III of the Ottoman Empire to celebrate the latter's ascension to the sultanate. Dallam traveled to Constantinople to install the instrument (1599–1600), and provided a lively account of this journey. He was more important as a pipe organ–builder, including instruments at Cambridge (King's College Chapel, 1605–06; case survives), Worcester Cathedral (under Thomas Tomkins's supervision, 1613–14; 2/12/no ped.; dism. 1640s; reb. several times; destr. 1829); and Durham Cathedral (choir organ, 1621). He may also have worked on an instrument at St. Nicholas, Stanford-on-Avon (1630; rest. Goetze and Gwynn, 2002).

The Worcester instrument is designed as a two-manual DOUBLE ORGAN, comparable to Italian organs of the period (Rome, S. Maria in Aracoeli, 1585–87, D. Benvenuti), rather than the separate Great and Chair organs styled after the Continental organ. This larger instrument had exclusively Octave stops, a preference that became part of an identifiable English sound that has never wholly disappeared. Even with the introduction of mutations and the strong influence of Aristide CAVAILLÉ-COLL, the typical English disposition was a major source for the Romantic organ. Nor did pedals become a regular feature in British instruments until the eighteenth century.

The conservatism of British organ building did not discourage the composition of a large repertoire of organ music at this time. The fifteenth-century solo organ piece developed into the voluntary, originally an improvised piece, which could take the form of a free fantasia, a piece based on a chant melody (cantus firmus), or a polyphonic, imitative piece similar to the ricercar, a new Continental instrumental genre of the sixteenth century that evolved into the fugues of Johann Sebastian Bach and others. The first significant manuscript of English organ music (British Library, MS Add.29996; mid-sixteenth- to mid-seventeenth centuries) contains liturgical organ pieces by many composers, including William Byrd, a recusant Roman Catholic who composed for the Anglican Church and had many powerful patrons (notably, Elizabeth I). A book compiled by the otherwise obscure organist Thomas Mulliner (ca. 1545–75) contains liturgical pieces, dances, intabulations of secular vocal and consort (chamber) music, and voluntaries by, among others, Thomas Tallis, Byrd's teacher and friend.

By the late Renaissance, the two secular genres of English keyboard were firmly established: the variation set or fantasy, and the dance pairing of pavane and galliard. The *Fitzwilliam Virginal Book*, a manuscript of over two hundred pieces compiled by an imprisoned Catholic recusant, Francis Tregian, between 1609 and 1619, contains a number of pieces suitable for the organ, given the absence of a pedalboard on English organs at this time. Other important late Renaissance English organ music was composed by John Bull, Orlando Gibbons, Peter Philips, Thomas Tomkins, and Christopher Tye. Increasingly, the style became a *stile antico*, to borrow an Italian term, as it went forward. Once the Restoration allowed the new concerted style to take hold in Britain, composers such as Henry Purcell found a path to the Baroque, much influenced by Italian music, but on their own terms.

See also **Baroque Organ; Classical Organ (Greek and Roman Antiquity)**

RICHARD KASSEL

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MELODIA

An open wooden Flute stop of 8’ pitch, usually made with inverted mouths. Its tone has been described variously as smooth, singing, round, rich, warm, and mellow. Audsley describes it as having a slight hornlike timbre in the tenor and middle octaves, and says that it “furnishes an admirable foundation for the most delicate labial and lingual combinations.” Sumner, on the other hand, calls it a poor blender.

The Melodia was popular in the United States and Canada from the middle of the nineteenth through the early twentieth centuries. There is some disagreement as to whether the stop was also popular in England (Audsley maintains it was unknown there); indeed, there is little evidence of its use outside of the United States and Canada. A number of authorities consider it similar or identical to the Waldflöte. It is not known who invented the Melodia, but the earliest known examples are by E. and G. G. Hook, who seems to have used it extensively. The scale of the Melodia is moderate to large. Audsley provides the illustration reproduced here.

See also **Stop**

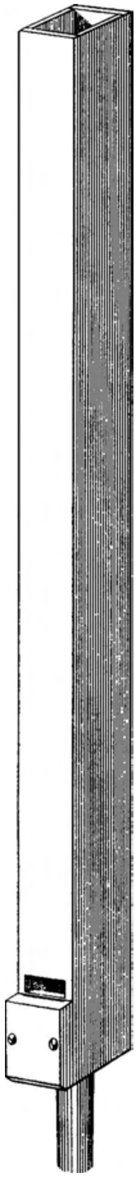

Fig. 57. Melodia.

Edward L. Stauff

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MERKLIN, JOSEPH (1819–1905)

German-born organbuilder, active in Belgium and France. Born in Oberhausen, son of the organbuilder

Franz Joseph Merklin (1788–1857), Merklin apprenticed with Friedrich Haas and E. F. Walcker and was foreman for Korfmacher. In 1843 he settled in Ixelles, Belgium, and successfully exhibited at the 1847 Brussels Exhibition. The Ducroquet firm, an early rival of Aristide Cavaillé-Coll, was purchased by Merklin in 1843, and a workshop was established in Paris. From 1853 on he was a partner with Friedrich Schütze, his brother-in-law. Merklin remained there until 1870, when he was forced into exile in Switzerland because of the Franco-Prussian War. Upon returning to France, he moved to Lyons but retained his Paris premises, returning to the capital in 1894. Throughout his career, Merklin forged business relationships with several organbuilders, including Joseph Gutschenritter and Pierre Schyven, who had taken over Merklin's Belgian operations in 1870. He merged operations with both his son-in-law Charles Michel and the Kuhn firm in Lyons to form Michel, Merklin, et Kuhn.

Merklin's technical innovations are noteworthy. In 1888, he installed an *orgue de choeur* in Paris, Ste.-Clotilde, with electro-pneumatic action. Its detached console was situated in the choir pews. A year later, Merklin placed an electro-pneumatic console, controlling both the *orgue de choeur* and the Grande Orgue, behind the altar (Paris, St.-Jacques-du-Haut-Pas). Though both instruments were approved by César Franck, they were controversial; yet they spurred further contracts for him. Merklin's instruments are generally characterized by strong, somewhat Germanic reeds, piercing cornets, and full-bodied choruses. Merklin's work has been overshadowed by that of Cavaillé-Coll, but his contributions to nineteenth-century French organ building merit further investigation.

Brian Doherty

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METZ, WILLIAM (1818–1896)

German-born American organbuilder. William (Wilhelm, Johann Wilhelm, John William) Metz, the first permanent organbuilder in St. Louis, Missouri, arrived there about 1845 as part of a wave of Saxon Lutheran immigration. Most of his organs were small, built for the young German congregations. In 1859 Metz won a medal for a chamber organ at the Mechanics' Fair in St. Louis. In 1860 he produced ten organs and employed seven men, installing instruments in Missouri, Illinois, and Indiana.

The only known surviving Metz organ was built in 1845 (1/4). The organ, now in the St. Stanislaus Jesuit Museum in Florissant, Missouri, was found in a basement chapel in St. Joseph's Catholic Church in St. Louis, and may have been the first organ for that congregation.

By the time the American Civil War had ended, Metz had moved to Collinsville, Illinois. John G. Pfeffer, who may have been associated with Metz briefly, took over Metz's St. Louis shop. Metz appears to have built few organs after his move. While his total output was not large, he had a reputation for high quality among the organbuilders and repairmen who later worked on his instruments.

Elizabeth Towne Schmitt

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METZLER

Swiss organ-building company. Jakob Metzler founded the firm at Graubünden in 1890; his son Oskar Metzler moved the firm (renamed Metzler und Söhne) to Dietikon, near Zurich, in 1931; it remains there. Oskar's sons Oskar Metzler, Jr., and Hansueli Metzler took over direction in 1968. A fourth generation of the family began managing Metzler Orgelbau (its latest incarnation) in 1990, Andreas Metzler becoming tonal director, and Mathias Metzler business manager.

After World War II, the firm embraced the European Organ Reform Movement and moved from respected national status to world renown as the leading Swiss organbuilder, with an installation at Zurich, Grossmünster (1960), becoming its signature instrument. That instrument and several others of the same period were built in consultation with the Danish organ consultant Poul-Gerhard Andersen. Metzler's favored style has been based on northern German classical models, although increased interest in Romantic organ music at the close of the twentieth century has

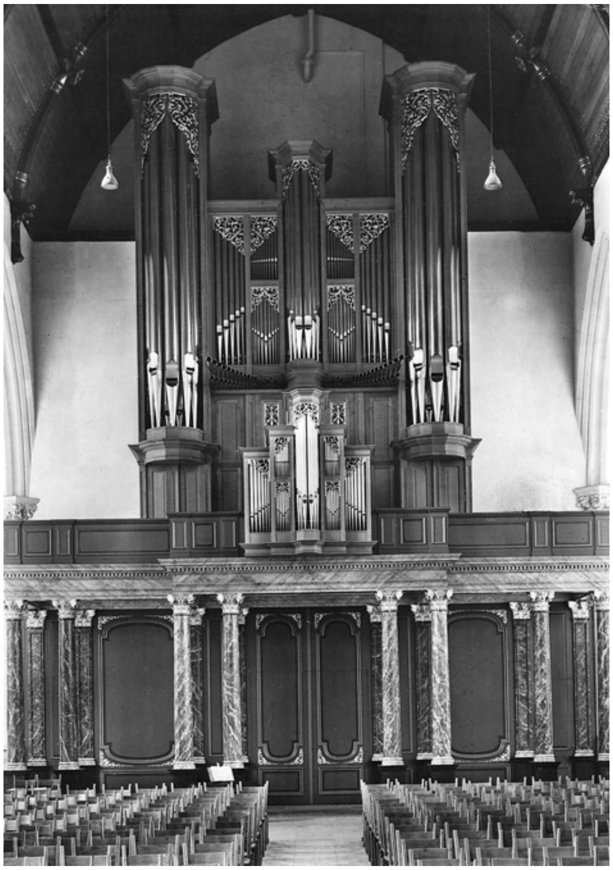

Fig. 58. Metzler & Söhne organ, 1971 (3/51), Grote- of St. Jacobskerk, The Hague, Netherlands.

led to the recent use of enclosed divisions and foundation stops of greater warmth. Unlike many builders of the late twentieth century, Metzler uses only mechanical key and stop action, avoiding performance aids such as combination actions or solid-state equipment; its last instrument having electric stop action was at Geneva, Cathedral of St. Pierre (1965). In addition to building all its organ components, as well as pipes, the company mills its own lumber.

Metzler's organs are characterized by traditional specifications, integrated ensembles, sensitive key action, and excellent construction. Noteworthy examples are The Hague, Grote Kerk (1971; 3/50, with 32' case); the Salzburg Cathedral (1988; 3/58); Antwerp Cathedral (1993; 3/45); and Trier, Stiftskirche (2000; 3/32). Metzler had built approximately six hundred organs by the turn of the twenty-first century. The firm is also noted for its restorations of such instruments as the 1767–69 Johannes Andreas Silbermann organ at Basel, Predigerkirche (1978; 2/28).

ARTHUR LAWRENCE

MEXICO

The first organs in Mexico (then part of New Spain) were manufactured at a music school for Indians founded by Franciscan friars in 1524 in Texcoco, outside modern Mexico City; these instruments were installed in churches in 1527. Diego de Chávez built a small organ for Guanajuato, Yuriria, San Agustín (1540s), considered among the most impressive in New Spain (destr. 1814). Within a few years, demand for more and larger organs, especially in churches administered by religious orders, gave Spanish builders the lead in their manufacture. These early organs were typically quite small and even portable, based on a 4' or 2', sometimes 3', Principal (Flautados). One sixteenth-century instrument, at Hidalgo, Meztitlan Convento de los Santos Reyes, is known to be extant. At least seventeen instruments were installed in the seventeenth century in what is now New Mexico; unfortunately, no trace of these remains.

Within the boundaries of modern Mexico, there remain many seventeenth-century and later instruments imported wholly or partially from Spain, as well as hundreds of native origin. Examples are the two Mexico City Cathedral organs, one Spanish (Sesma, 1696; rest. FLENTROP, 1975–78), still in regular use, and one Mexican (Nasarre, 1736; rest. Flentrop). The seventeenth-century organ at San Jerónimo, Mexico City, was restored by Joachim Wesslowsky (1981); another period instrument, in Oaxaca, Yanhuitlan, San Domingo, was restored by Pascal Quoirin (1998). Meanwhile, a local organ-building trade began to develop, to an extent not found elsewhere in Latin America. Spaniards who came to New Spain to install instruments stayed, starting an industry that their native Mexican apprentices continued. Among the latter were Diego Suárez de Grimaldo (Michoacan, Morelia, Cathedral, 1704), Juan Téllez Girón y Bracamonte (Federal District), Francisco Peláez de Ugarte (Durango Cathedral, ca. 1713), Bernardo Rodriguez (Tlaxcala, Santa Anita Huiloac, 1714), the Casela family (Tepozotlán, Jesuit monastery, 1749), and José Antonio Sanchéz (Taxco, Santa Prisca, 1759–60). The locally-built organs emulated the Spanish traditions of DIVIDED STOPS, plentiful and powerful EN CHAMADE REEDS, and stops such as the Pájaros, Tambores, Campanas, and Timbal, nearly to the end of the nineteenth century (e.g., San Luis Potosí, Cathedral of San Luis Rey de Francia, Orriza brothers, 1866). Local builders dominated Mexico's organ industry in the nineteenth century Among the more important were Francisco Pérez de Laxa (Mexico City, Las Vizcain, 1834), Manuel and Antonio Suárez (Hidalgo, 1840s–50s), the Castro family, especially Miguel Gregorio Castro (Cholula, Santuario de los Remedios, 1/8; rest. Quoirin, 1994), and the Olvera brothers (Mexico City).

Starting in the mid-nineteenth century, following political independence from Spain, Mexico began to show some French and German influences in its organs. Organist and organbuilder Francisco Godínez studied in Paris and built forty French-style instruments in Mexico. More than one hundred E. F. WALCKER organs were installed in many Mexican states, primarily between the turn of the twentieth century and the start of World War I and then after that war until the persecution of the church by the government (mid-1920s). The largest of these instruments is found in Morelia Cathedral (1905; 56 registers; reb. Tamburini, 1961). As much as Aristide CAVAILLÉ-COLL, German-born Joseph MERKLIN represented the French style in Mexico, notably in Guadalajara's Cathedral (1889–93, extant), and Monterrey.

Other foreign builders entered the Mexican market in the twentieth century, including CASAVANT FRÈRES, ESTEY (Mexico City, Los Reyes, Christ Church, early 1900s; rest. E. Lapatié), RIEGER, SCHLAG und Söhne, and WELTE (León Cathedral, 1939; reb. 1942, 1987), Seifert (Mexico City, Florida, Santo Tomás Moro, 1970), and the German-born Alfred Wolburg, a former Walcker agent. More recent instruments in Mexico City include the TAMBURINI organs at the Mission Seminary at the Universidad Intercontinental (1957) and the National Conservatory of Music (1965), as well as the 1977 Casavant (5/123) in the "new" Basilica of Our Lady of Guadalupe (the old basilica has a 1931 WURLITZER four-manual). The Lutheran Church of the Holy Spirit hosts the first important neobaroque organ in Mexico (Weissenborn, 1954; three manuals). The largest Latin American organ is the 15,633-pipe, 50-ton Tamburini-Riojas (1958; 5/198; rest. Realejo, 1999–2000) in the National Auditorium in Mexico City, Chapultepec. Other secular organs include those at the National Music School at the National University (J. Wesslowsky, 1987), and the National Art Center (Pels, 1994). Larger organs in Guadalajara include the Cathedral (Merklin, 1893; three manuals; reb. Walcker, 1922; reb. Tamburini) and the Templo Expiatorio (Tamburini, ca. 1995; three manuals). Puebla Cathedral has an AUSTIN (four manuals; reb. Frels). Native Mexican organbuilders of the twentieth century include Jesús V. Acosta, Pedro and Juan Pérez Cortez, Rafael Latapié and his son Eugenio, and the teams of Delfino and Eugenio Madrigal and Daniel Ramírez and Jorge Peralta Escobar.

Much of Mexico's greatest music has traditionally been associated with Mexico City Cathedral since its foundation. Fray Juan de Zumárraga, who would become the first bishop, specified in 1534 that, in addition to a *chantre* (cantor and choirmaster), the cathedral had to pay an organist a stipend of sixteen pesos. Hernando Franco, maestro de capilla (1575–85) is the first composer whose fame extends to this day; Manuel de Sumaya (1678–1756), maestro de capilla from 1715 to 1739, composed for organ as well as the first Mexican opera.

More recently, Padre Velázquez (d. Querétaro, 1920) and Agustín González studied in Regensburg, Germany, and founded a great organ school in Querétaro; Velázquez was later organ instructor at the Conservatorio Nacional (1902–14). Miguel Bernal Jiménez (1910–1956) of Morelia, in Michoacán, who directed Morelia's Conservatory of Las Rosas, was a prolific composer; at present, his works for organ are largely unpublished. Other important organ composers were Luis G. Jorda (1870–1955), a Spaniard who lived in Mexico City for about twenty years; Julian Zuñiga (b. Querétaro, 1893; d. Mexico City, 1972); Jesús Estrada (b. Teocaltiche, Jalisco, 1898; d. Mexico City, 1980), who helped design the two secular Tamburinis organs; Ramón Noble (b. Pachuca, 1920; d. Cuernavaca, 1999); and Alfonso de Elias (b. Mexico City, 1902; d. there, 1984). José Suárez Molina of the Conservatorio Nacional is Mexico's best-known performer of early Iberian music.

Mexico has become the site of several organ festivals, including the Festival Internacional de Organo, in Morelia Cathedral (since 1967) and a second festival at the cathedral in Guadalajara; the Festival Internacional de Organo Barroco in Mexico City Cathedral and in Ocotlán and Magdalena Tlatelulco, both in Tlaxcala (since 1993); the Academia Mexicana de Música Antigua para Organo; and the Festival Internacional de Música para Organo in Oaxaca (begun 2001). Recently, La Asociación de Organistas Mexicanos was formed; it is based in Mexico City.

The rich legacy of historical organs in Mexico has begun to be appreciated. Conservation organizations include the Instituto de Organos Históricos de Oaxaca, founded by Cecilia Winter and Edward Pepe, and Organos Protege AC. Joachim Wesslowsky has maintained a restoration workshop in Mexico City for many years. His restorations and reconstructions include organs at Taxco, Guerrero, Santa Prisca (anon. ca. 1760; rest. 1987–88) and Guanajuato, La Valenciana. Susan Tattershall has also been responsible for the restoration of organs, notably instruments in Oaxaca Cathedral, Oaxaca, San Jerónimo Tlacochahuaya, and Federal District, Tepotzotlán. Alejandro Vélez, a harpsichord builder working in Mexico City, restored the organ in San Cristobal, Chiapas. Also important is the work of Eduardo Bribiesca, Daniel Guzmán (Escuela Nacional de Restauración) and José Luis Falcón. Inventories of organs in the central states of Puebla and Tlaxcala have been made by Josué Gastellou and Gustavo Mauleón, and a preliminary register of instruments in Oaxaca has been prepared by Gustavo Delgado and Ofelia Gómez (see Bibliography).

See also **Central and South America**

Richard Kassel
Daniel Muller
Jesús Bernal

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MICHELL, CARLTON C(UMBERBATCH) (CA. 1835–1921)

English organbuilder, also active in the United States. Michell, born in Lymington, demonstrated an interest in organ building at an early age; he later moved to London, working as a schoolmaster, accountant, and church organist. In the early 1880s, he formed a partnership with William Thynne (1839–1897), who had worked with T. C. Lewis from the 1860s on.

Builders such as Henry Willis and Walker built instruments for the 1885 Inventions Exhibition in South Kensington. Michell and Thynne contributed an instrument (4/35) using locally produced pipework; Michell described the organ as a "*multum in parvo* . . . plac[ing] in the hands of the player a grand and complete organ reduced to the smallest possible . . . number of slides." The original plan featured historic chest divisions: an unclosed Choir organ in front, with the console underneath; above and behind that was the Great, beyond that the Swell, and the Solo at the top. However, the exhibition site required that the organ be placed on a platform, necessitating the shifting of the console and Solo organ to the side and reconstruction of much of the key and stop action. The instrument eventually won a silver medal for "superior voicing and specialties in tone colour." After being shown at the Liverpool Exhibition the following year, it was purchased and donated to St. Mary's Abbey, Tewkesbury. The organ escaped "modernization" and was partially rebuilt by Bishop and Son (1981; tub./pneum.). It retains its characteristic blend of power and distinctive stops as well as its prophetic uncased construction.

Michell and Thynne went bankrupt in 1888, and Michell went to the United States about a year later. He criticized American-built instruments for their "panting and gasping for air of an instrument inadequately winded . . . construction entirely defective, primitive to a degree." He first worked with George S. Hutchings in Boston, voicing the organ at Brooklyn, New York, New York Avenue Methodist, 1890 (3/60). By 1892, Michell was working with another Boston firm, Cole and Woodberry. Their first collaboration was a three-manual, tubular-pneumatic instrument at Boston, St. Stephen's (1892; now Boston, Most Precious Blood [RC]; electrified Lahaise, 1956). The instrument borrowed the "functional" pipe display of the 1885 Exhibition organ (and used seaweed in its swell box).

Cole, Woodberry, and Michell built another tubular-pneumatic organ for Germantown, Pennsylvania, St. Luke (Episcopal), 1893–94 (3/39; reb. Casavant, 1956). Its tonal design reflected Michell's pre-U.S. proposals, with separation into North (Great; Pedal subdivision, or Bombard) and South (Swell; Choir; Pedal subdivision) organs; the Great was further divided into three subdivisions, including an enclosed Echo organ. Ernest M. Skinner and G. D. Harrison studied this instrument closely; subsequent alterations have apparently softened its tone. Later collaborations were for Germantown, Pennsylvania, Polite Baptist, 1897 (two manuals) and Wissahickon Heights, Pennsylvania, St. Martin (Episcopal), 1897 (3/26).

The peripatetic Michell now went to New York and "amalgamated" with George Jardine and Son, now run by the founder's grand-nephews. He helped build tubular-pneumatic organs at Taunton, Massachusetts, St. Thomas (Episcopal), 1897–99 (3/34; reb. Roche, 1980; now electro-pneum.) and Camden, New Jersey, St. Paul (Episcopal), 1898 (three manuals). Michell renovated an 1885 four-manual Roosevelt organ at New York, St. Gladys de la Croix (1898; reb. Willis, 1942; 6/488). After the Jardine company was dissolved (1899), Michell landed at the Austin Organ Company in Hartford, Conneticut (ca. 1900–1904). During his tenure, the firm built a Michell-influenced subdivided instrument at Philadelphia, St. Mark's (Anglican), 1902 (4/38; repl. Aeolian-Skinner, 1937).

Michell introduced Robert HOPE-JONES to the Austin firm, but left after considerable conflict with his fellow Englishman. He returned to England and established a pipemaking and voicing firm in Wakefield, West Yorkshire, exporting goods to as far away as Australia. He contributed his always feisty, extremely self-confident correspondence in *Musical Opinion*, assisted George Dixon and HARRISON AND HARRISON in building the organ at Ely Cathedral (compl. 1908), and provided fluework for the Casavant at Toronto, St. Paul, Bloor Street (1914). After a difficult wartime period, he returned to Wakefield in 1919. He died in Brentford, near London.

Although most of his work was collaborative, Michell influenced a large number of builders, whether Hope-Jones (whose own "multum in parvo" eventually produced the UNIT ORGAN), English builders (Dixon, Harrison and Harrison, Thynne), English builders in the United States (Austin, G. D. Harrison, Jardine, Woodberry), or American builders (Cole, Hutchings, Skinner). His skillful voicing served as a model, while his subdivision-based designs, while lost in the orchestral organ ideal of the early twentieth century, resurfaced in the work of the neoclassical builders and beyond.

STEPHEN BICKNELL

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MICROTONES

SEE SUBSEMITONES

MIDI (MUSICAL INSTRUMENT DIGITAL INTERFACE)

SEE ACTION; ELECTRONIC ORGAN; MECHANICAL AIDS; PEDAGOGY; RECORDING TECHNIQUES; SOUND EFFECTS

MIDMER (MIDMER-LOSH)

American organ-building firm. Reuben Midmer (b. Sussex, England, 12 Aug 1824; d. 1895) emigrated to New York around 1840, apprenticed with Thomas S. Hall, then worked for Richard M. FERRIS, and then for STUART, where he became shop foreman. In 1860, Reuben Midmer opened his own shop in Brooklyn; his son, Reed Midmer (b. 1850s; d. 27 May 1918), became a partner in the renamed Reuben Midmer and Son (1875). The elder Midmer retired in 1888, and Reed took over day-to-day operation of the firm. Upon his father's death, Reed bought out the former's share from his estate, and in 1907 moved the shop to Merrick, New York. Most of the company's production and larger instruments date from this relocation.

Reuben Midmer's shop produced relatively few instruments, mostly one- and two-manual organs for local churches. The two three-manual organs from the period were both for Brooklyn churches, St. Patrick's (1869) and St. Mary's Episcopal (1871). Under Reed Midmer, the company's operations expanded. The company's 1917 brochure shows installations as far away as California; however, the majority of the company's trade remained in New York, New Jersey, and Pennsylvania. Both early and late organs show unremarkable tonal designs and indifferent quality both of materials and workmanship.

After Reed Midmer's death, his son Reed Jr. lost control of the firm and formed his own company, Midmer-Light. The original firm was purchased in 1920 by the brothers C. Siebert Losh and George Losh, and became Midmer-Losh. Midmer-Losh built three large "orchestral unit organs": the three-manual instrument at Miami, Central Christian, 1925, with a seven-octave lower keyboard, and two instruments designed by Emerson RICHARDS: Atlantic City, New Jersey, High School (1924; 5/165, based on only 86 ranks; dism.), and the self-described "world's largest organ in the world's largest auditorium," the Atlantic City Convention Hall (now Boardwalk Hall; 1929–32). Its dual consoles (seven and five manuals, respectively) controlled 1,439 stops (455 ranks), keyboards of large compass (eighty-four and seventy-two notes), twenty-two divisions, and between 32,000 and 33,000 pipes.

JOHN K. OGASAPIAN

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MIELCZARSKI, MATEUSZ (1812–1868)

Polish organbuilder. One of the most prolific Polish builders of the mid-nineteenth century, Mielczarski was founder of the so-called Warsaw school. A pupil of Karol Zakiewicz in Brzeziny, Mielczarski started working on his own in Lowicz (1838), then moved to Warsaw (1847). In his small workshop he built over one hundred instruments before his premature death, resulting from an accident while building an organ at Warsaw Cathedral (3/54). His surviving organs, including Lad (1858; 2/21) and Warsaw-Wilanów (ca. 1861, 2/20), are marked by superb workmanship and excellent tonal quality. These assets, combined with self-sufficiency (he made his own stops, including reeds) and low prices, allowed him to compete with foreign builders who appeared on the Polish market. A real enthusiast of his craft, he left no fortune, but a number of gifted pupils and successors, including Waclaw Przybylowicz and Józef Szymanski.

JERZY GOLOS

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MILNAR

American organ-building firm. Dennis Philip Milnar (b. Buffalo, New York, 1943) trained and worked at Delaware Organ Company in Tonawanda, New York (1961–68), a firm heavily influenced by Herman L. SCHLICKER, notably in its pitman WINDCHEST construction. Milnar helped finish Delaware organs in Buffalo, New York City, and Yonkers. In 1968 he decided to start Milnar Pipe Organ Service in Nashville, representing the Delaware firm and installing instruments in several Tennessee churches. In 1976 he moved the company to a new workshop in Eagleville, Tennessee, changed its name to Milnar Organ Company, and began constructing his own instruments.

Milnar used his experience to develop a WINDCHEST requiring little attention, but easy to service if needed. The windchest's bottom consists of panels that sit in a frame lined with a closed-cell neopreme (a form of synthetic rubber). To expose the inner works one lifts and slides the panels away (possible even with the wind on). The pipe valve employed is a solenoid-style vertical pallet magnet, chosen for its friction-free movement and its dampening ability to aid in pipe speech. An arch suppression diode is added to the magnet coil to lengthen key contact life. Solid-state combination actions and relays are used in every Milnar organ.

Recent instruments of note include Nashville, Holy Trinity Lutheran (2002); Murfreesboro, Tennessee, St. Mark's Methodist; Manchester, Tennessee, First Baptist; and Huntsville, Alabama, Holy Spirit Catholic (1990). Major organ renovations include Nashville, Blair School of Music; Hendersonville, Tennessee, First Baptist; Murfreesboro, St. Rose Catholic; and Huntsville, Church of the Nativity (1990).

DENNIS P. MILNAR

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MIRRLEES

Scottish organ-building family. Robert Mirrlees started building organs in Glasgow around 1810, remaining in business until 1857. Two years later, his sons took over under the name J. and A. Mirrlees. Few examples survive of either the founder's work or that of his sons. One of Robert Mirrlees's masterpieces was built for Glasgow, St. Andrew's Metropolitan Cathedral (dism.). J. and A. Mirrlees built a fine organ in St. Andrew's Parish Church (ca. 1866; 3/34; reb. 1910, 1955; partially extant), awaiting sufficient interest in a restoration. Other surviving Mirrlees organs can be found at Edinburgh, Canongate Kirk; Clydebank, Our Holy Redeemer (1867, acquired 1996); Greenock, St. John the Evangelist Episcopal (ca. 1878); and Glasgow, St. George's Episcopal (1893; reb. Hilsdon, 1925). J. and A. Mirrlees ceased operation in 1949.

JOHN POWER

MITER

The use of one or more beveled joints in a flue RESONATOR that convert it from a straight PIPE to one with a "bend" of one or more angles, adding up to 90° or even 180°. (The term *resonator*, usually applied to reed pipes only, is sometimes applied to the upper part of a flue pipe.) A flue resonator is mitered for two reasons: to save vertical space, or to redirect the sound projection. Mitering a pipe has only a small effect on the quality of the sound, but the change of direction in an open pipe can cause the projection of the sound to be very different. In the case of stopped wooden pipes, there is no change, as the sound is heard through the mouth.

Mitering a wooden pipe requires the maker to deal with the inflexibility and vulnerability of the material. To produce a 90° angle (so that the sound travels on a horizontal plane), the pipemaker tunes a wooden pipe, bevels it to the desired height at a 45° angle, then turns the upper piece 180° and attaches it to the bottom piece to produce the 90° mitered pipe, using glue and a spline (interlocking) joint between the pieces. To produce a 180° angle, the resonator is cut so that it "wraps around" at the top, maintaining consistent dimensions and using one piece of wood for the two sections created by the internal wall. In effect, the pipe consists of one resonating space that has been folded over and covered with one piece of wood. In either method, the issue of stability has been dealt with.

The advantage of mitering with a more flexible material in a metal pipe is offset by its greater complexity; the malleability of metal proves both a positive and a potential pitfall. The softer the pipe metal used (e.g., with high lead content), the more likely the weight of the mitered pipe would pull itself apart; thus, extra support must be provided. As in the first type of wooden mitered pipe described above, metal pipes are cut at the desired points and put together, not with glue and spline joint but solder. Tapered pipes, including reed resonators, are the most difficult to miter, as there is no room for error.

In theory, metal pipes can be mitered at a 90° angle, requiring two seams (rather than the one joint for wooden pipes) beveled at 22-1/2°; but the tone and weight of the pipe may cause problems. More common are pipes mitered at 180°, using four seams of 45°; after cutting, the seams must match up and the resonators must have retained their proper shape. (Larger pipes may benefit from additional beveling at the joint, to aid the solder's coverage.) The type of pipe metal used determines the preparation of the seam edges, using pre-tinning (coating with tin to reduce corrosion), taping or sizing (to protect against the soldering heat), or paste flux (for zinc pipes); pipemaker's wax provides a final protective coat before soldering. After the process is complete, sagging on larger pipes (e.g., Gedeckt basses) may be prevented by installing an angled brace (a piece of pipe metal folded into a narrow *V* channel) between the unbent part of the body and the last mitered section.

See also **Nicking**

RICHARD KASSEL

MIXTURE

A type of compound stop composed of several ranks of pipes at octave and fifths (occasionally thirds and other pitches) designed to produce the penetrating chorus sound typical of most organs. A mixture stop involves the "breaking of ranks"; that is, the pitches sounded by depressing a key in a Mixture are based on more than one fundamental (first partial); only a few pitches from a particular rank are chosen before a different set of pitches is chosen from the next higher rank, and so on. Mixtures may use any number of ranks, indicated in the stop name by a roman numeral. This repetition of pitch is not mere doubling; as the ranks change, so do the partials that produce a specific pitch (see below).

The added emphasis on higher pitches provided by mixtures can help clarify, intensify, or enliven tone; create a sense of "wholeness" by heightening inner partials or filling in registrational gaps; extend the power of Solo stops, extreme ranges, and individual divisions; or produce an effective accompanimental sound. Resultant tones (produced by the "addition" or "subtraction" of frequencies) may also play a role, as would different sonorities and even pipe shapes mixed together.

Mixtures may be designated simply as such; more popular mixtures have developed names of their own, such as COMPENSATING MIXTURE (for the Pedal), PROGRESSIO HARMONICA, Fourniture (all OCTAVE and QUINT stops), HINTERSATZ, PLEIN JEU, SCHARF, and SESQUIALTERA.

The earliest mixture was an early subdivision of the BLOCKWERK, independent of the Principal/Prestant and Flute ranks, called the Cymbale (CYMBAL, ZIMBEL); this was a high Chorus stop, in theory comprising Octave and Quint stops only. By the seventeenth century, TIERCE and other stops had begun to appear in French/Iberian Mixture stops. The Tierce-based Mixture (in addition to the JEU DE TIERCE, a compound but not a mixture stop) became part of the essential French sound, one that survives to the present day, even when most other nations were either continuing to emphasize ALIQUOT registrations (as in England, Italy, and the United States) or moving toward them (as happened most dramatically in the Netherlandish and German organ between the seventeenth and nineteenth centuries).

The history of the mixture reflects national characteristics and changing tastes, and the contents, voicing, and scaling of the various kinds of mixture combinations vary more—and challenge the builder more—than any other single stop. Here are the components of a basic Fourniture III stop (see Irwin):

RICHARD KASSEL
MARCO TIELLA

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Key	Stop	Register(Pitch)	Stop	Register(Pitch)	Stop	Register (Pitch)
CC to BB	22	1 (c”)	26	2/3 (g”)	29	1/2 (c”’)
C to B	19	1-1/3 (g”)	22	1 (c”’)	26	2/3 (g”’)
c–b	15	2 (c”’)	19	1-1/3 (g”’)	22	1 (c””)
c’–b’	12	2-2/3 (g''')	15	2 (c'''')	19	1-1/3 (g'''')
c''–c''	8	4 (c'''')	12	2-2/3 (g'''')	15	2 (c''''')
Key = note played Stop = interval above fundamental Pitch = resulting pitch (c’ = middle C)						

MOITESSIER, PROSPER-ANTOINE (CA. 1807–CA. 1867)

French instrument maker. Born in Carcassonne to a family of stringed instrument makers from Mirecourt, Moitessier lived and worked in southern France. He was apprenticed to his cousin M. Lété who, in association with Jean-Baptiste Vuillaume, made organs and violins; they were also influenced by John ABBEY and Pierre Erard, and started making pianos. Moitessier’s first important organ contract was for Montepellier, Protestant Church, which he adjusted to equal temperament, and added an innovative transposing keyboard. He then restored the L’ÉPINE organ of Lodève, St. Fulcran, and won a gold medal at the 1839 Montpellier Exhibition. In 1841 he built a four-manual 16’ organ with swell box for Béziers, St. Madeleine (extant) and a three-manual neoclassical organ for Sète, St. Louis (1843; rest. 1976; probably his finest surviving instrument). He restored the François BÉDOS DE CELLES organ of Montpellier, Notre-Dame-des-Tables (1846), and rebuilt the instrument at Tarascon, St. Marthe, with a “German” pedalboard.

The forty-two-stop instrument Moitessier built for Toulouse, Dalbade Church (1850) includes an early form of tubular-pneumatic system (influenced no doubt by Lété’s earlier experimentations) that he developed in later organs but which never competed seriously with the BARKER LEVER. His remaining work comprised smaller contracts, mainly in Provence: Aix-en-Provence (Church of the Holy Spirit, 1850, and La Madeleine, 1856), Remoulins (1851), Valréas (1855), and Martigues (1860). Moitessier then devoted himself to piano construction. He died in Monpellier at around sixty years of age.

DOMINIQUE CHAILLEY
CHRISTOPHER HAINSWORTH

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MOLLER

American organ-building firm founded in 1875 in Warren, Pennsylvania, by Danish-born Mathias Peter Moller (1854–1937; originally spelled Möller, a form rarely used in later years). Moller apprenticed for nine years to a Copenhagen organbuilder before emigrating to the United States in 1872, working initially for Derrick and Felgemaker of Erie, Pennsylvania. One of his first instruments, intended for the 1876 Centennial Exposition in Philadelphia but not finished in time, subsequently went to the St. George Society in the same city. In 1877 the business moved to Greencastle, Pennsylvania, but in 1880 relocated to Hagerstown, Maryland, where it became the country’s largest organ manufacturer. After the move to Hagerstown, a growing reputation for quality instruments necessitated enlarging the original plant six times; a fire in 1895 completely destroyed the property but orders on hand ensured continuing production at a new and larger site nearby.

Moller organs were built with mechanical action into the early twentieth century; pneumatic action followed and gave way to electro-pneumatic action, which became standard after 1923. The firm built some of the largest organs in the country but also developed small self-contained instruments, first the Artiste series and later Series 70. Among its best-known installations are those at West Point, New York, Cadet Chapel, U.S. Military Academy (1911, 1985; 4/302); New York, St. George’s Episcopal (1958); Washington, D.C., National City Christian (1985; 5/141); and Charlotte, North Carolina, Calvary Church (1990; 5/205). A unique instrument was Moller's 1938 touring theater organ (5/27 ranks), built for Reginald Foort and used by the British Broadcasting Corporation, and then the Dutch government; it is now installed in the Pasadena (California) Civic Center.

More than eighteen hundred mechanical action organs were built before the company turned to electropneumatic action, and a total of 11,851 new instruments had been produced by 1991. Its tonal design generally followed American trends, beginning with a conservative style and moving to the use of more upper work and reeds after World War II. Some 5,500 additional projects involved rebuilding, additions, and consoles.

When the founder died, his son M. P. Moller, Jr. (1902–1961) became president; on the latter's death, W. Riley Daniels, his brother-in-law, assumed the leadership. Grandsons Kevin Mackenzie Moller and Peter Moller Daniels served brief terms as president, beginning in 1978 and 1984, respectively. Family control of the business was relinquished in 1986 when Ronald F. Ellis became president; a consortium of four area businessmen purchased the firm in April 1989. Prolonged labor strikes in 1988 and 1992 caused factory shutdowns, and labor problems combined with a multimillion-dollar deficit led to the business being taken over by its unions (1992). The firm closed that year; some employees subsequently joined Eastern Organ Pipes and the Hagerstown Organ Company.

Arthur Lawrence

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MÖLLER, JOHANN PATROKLUS (1698–1772)

German organbuilder; his middle name is often spelled Patroclus. Baptized in Soest, Westphalia, on 19 September 1698, Möller was successful by age twenty; he demonstrated his business acumen when, in 1720, he built a new organ for Soest, Thomaeskirche, for 650 Reichstalers, took an old organ in exchange (value: 50 Reichtalers), repaired it, and sold it to Ostönnen, St. Andreas for 200 talers. (The latter amount was more than Johann Sebastian Bach made in a year in Weimar.). Möller became a citizen of Lippstadt in 1722, and he claimed that city as home for the rest of his life. He married into two organ posts (both wives died) and maintained them while continuing to build organs. (He and his three wives produced a total of eleven children, only three of whom made it to their fourth birthdays.) Möller quickly became a leading builder in Westphalia. Despite the considerable demands put on his time, he built at least fifteen new instruments and restored or rebuilt some forty others; he has been described as a "workhorse of artistic rank." Möller built for both the Lutheran and Roman Catholic Churches; he was active until at least 1769.

Möller was perhaps the most important Baroque builder in Westphalia, and used spring-chests to the end of his career. His instruments include: Ostönnen, St. Andreas, 1722 (rest. R. West, 2003; now 1/8/pull-down); Soest, Thomaeskirche, 1725 (reb. 1822; 2/22; dism. 1874); Herford Münster (enl. 1684 H. Reinking organ, 1/20; 2/34; dism. 1868); Soest, St. Mariae zur Höhe, Rückpositiv, 1730; Marienmünster-Höxter, St. Jakobus der Ältere, 1737–38 (3/42; rest. Breil, 1966); Geseke, Franciscan monastery, 1741 (2/24; to Büren, Jesuitkirchen, 1837); Harsewinkel-Marienfeld, Cistercian abbey (reb. D. Bader organ, 1746–51; 2/30; reb. Breil, 1961–62; now 3/41); Hoinkhausen-Rüthen, Pankratiuskirche (reb. anon. 1660 organ, 1747; 2/33; rest. Kemper, 1956); Böddeken, Augustinian monastery, 1747 (with son Johannes Müller; 3/43; to Büren, St. Nikolaus, 1804; rest. Fischer and Krämer, 1993); Dahlheim, Johanniskirche (reb. G. Bader organ, ca. 1751; 3/45; to Borgentreich, St. Johannes, 1803; rest. P. Ott, 1953; orig. spring-chests extant); and Münster, St. Paulus-Dom, 1755 (3/54; reb. Kersting, 1862; destr. 1945).

Richard Kassel

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MONTRE

See Principal

MOORE, (A.) DAVID (B. 1946)

American organbuilder. Born in Hanover, New Hampshire, on 8 February 1946, he graduated from the University of Vermont, then made two study visits to Europe. He worked at C. B. Fisk, Inc. (1969–72), then opened his own shop in North Pomfret, Vermont (1973). His first new organ was a one-manual instrument (1972; now at Sweet Briar College, Sweet Briar, Virginia). His interest in restoration of early American organs is demonstrated by his work on of the Stevens and Jewett organ (ca. 1845; now in the Chapel of the Soldiers’ and Airmen’s Home in Washington, D.C.; rest. 1989).

Moore constructed a new instrument behind the existing 1759 facade for Boston, Old North (Christ) Church, using a disposition based on early English practices. The centerfold of its double-fold reservoir is held up by a wooden pulley and rope. When the organ is hand-blown, this centerfold (dropping at half the rate of the top fold) and the top fold move slightly, resulting in a free wind supply devoid of unsteadiness. (An electric blower is also provided.) At St. James, Woodstock, Vermont (1987), Moore introduced an electric system to move the two wedge bellows, without an intervening reservoir.

The 1981 organ at Grace Church, Washington, D.C., is a fair example of the firm’s work. Pedal pipes are placed in towers to the left and right of the main case, which houses both the Great and Positiv. The organ is located in the west gallery. Its disposition is as follows:

Great		**Positiv**	
Bourdon	16	Chimney Flute	8
Principal	8	Spire Flute	4
Octave	4	Fifteenth	2
Mixture	IV	Larigot	1-1/3
Superoctave	2	Cromorne	8
Cymbal	IV		
Sesquialtera	II	**Pedal**	
Quint	2-2/3	Bourdon	16
Bourdon	8	Principal	8
Trumpet	8	Octave	4
		Trumpet	8
		Trombone	16 (prepared)

Suspended key action

Couplers: Great to Pedal, Positiv to Pedal, Positiv to Great

Adjustable tremulant (all divisions)

Combination Pedal for Great

Other new instruments include those at Marianna, Florida, St. Luke’s (1982); North Easton, Massachusetts, Chapel of Mary, Stonehill College (1985); and Boston, Chapel of St. Mary’s Convent (1992).

Moore’s organs are clearly in the neoclassical mode, characterized by encasement, flexible winding, mechanical stop and key action, and a disposition providing a Chorus of pitches on each division. Moore is at times apprehensive of earlier neobaroque practices, which can involve mixture stops of rather narrow scale and a large number of ranks. He prefers to reduce the number of ranks in mixtures, in order to voice a smaller number with as full a sound as possible.

John T. Fesperman

MOORS

South Netherlandish family of organbuilders and organists, also known as Mors. Of the two branches of the family, the more prominent organbuilders came from Antwerp; the Moors of Lier (near Antwerp) were primarily organists.

The founder of the Antwerp line, Anton Moors I (b. ca. 1485; d. Antwerp, 1539), apprenticed with Jan de Bukele in 1504, and became organist at St. Michael, repairing its organ in 1514. He built small organs for royal chapels in Brussels (1514) and The Hague (1515). He later built an organ for Leuven, St. Peter (1523) and a positive for ’s Hertogenbusch, Liebfraukirche (1525), and repaired organs for Margaret of Austria (the Dutch regent) and Saint-Omer, St. Bertin (both 1529).

Anton's sons Cornelis Moors (b. Antwerp, ca. 1500; d. there, 1557) and Anton Moors II (b. Antwerp, ca. 1500; d. by Aug 1562) were organbuilders. Cornelis built instruments for Ghent, St. Michielskerk (ca. 1542), Oudenaarde, St. Walburga (ca. 1545; 2/14/pull-down). Anton II built an organ for Dendermonde, Our Beloved Lady (1555–60) with four divisions (Rugpositief, Borstwerk, and a divided Hoofdwerk), twenty-eight stops, and pull-down. He went to Mecklenburg, Germany to work for Duke Albrecht (1555–57; his Antwerp business was apparently taken over by the Brebos family). Anton II repaired and enlarged the organs at Schwerin Cathedral (1558) and Güstrow Cathedral (1558). He worked for Elector Joachim II Hector in Berlin (1559–60), where he probably built the so-called Mary Organ. The Schwerin contract describes Anton II as a builder who improved on German instruments by grafting the "new and strange voices" of the Brabantine builders, originally brought to the Netherlands by Rhenish masters Hans SUISSE and Peter BREISIGER.

Jakob Moors (b. Antwerp, ca. 1515; d. ?Berlin, between 1585 and 1602) and Hieronymus Moors (b. Antwerp, 1521; d. Schwerin, 16 Dec 1598), also sons of Anton I, were prominent court organists, as were Anton Moors III (b. Schwerin, ca. 1555; d. Rostock, 1619), son of Hieronymous Moors, and Joachim Moors (b. ?Berlin, ca. 1560; d. after 1605), son of Jakob Moors.

Less is known about the activities of the Lier branch of the Moors. Mark Moors I (d. Lier, 1525) built a "manucordium" for the future Holy Roman Emperor Charles V (1508). Hendrik Moors built a small organ for Charles V (1517), and Mark Moors II (d. after 1535) was a musician in Charles's chapel. This branch also provided three generations of organists (all named Bernhard Moors) for Lier, Saint Gummarus.

RICHARD KASSEL

MOREAU, JACOB FRANÇOIS (CA. 1684–1751)

Dutch organbuilder; also known as Jacobus Franciscus Moreau. He was probably born in Flanders, but by 1693, the family was living in The Hague. Moreau may have worked for Louis DELHAYE at Ghent; he married Delhaye's daughter in 1724. From 1718 on, Moreau lived in Rotterdam. He carried out maintenance and repair work in the southwest part of the Netherlands and built harpsichords, house organs, and small church organs, including the instrument for Rotterdam, Oosterkerk (1723, now at the Prinsekerk), using parts of the former NIEHOFF organ (1560) of the city's Grote of St. Laurenskerk. In 1732, Moreau was commissioned to build a new organ for Gouda, St. Janskerk (1733–36, extant); this instrument was to become his magnum opus. Although the specification of the Gouda organ shows many similarities with the Christian MÜLLER organ at Haarlem, St. Bavo's (1738), the Gouda organ was more Flemish in character, while the Haarlem organ shows a balance of Dutch and middle-German influences. In his famous comparison of the two organs, Georg Joseph VOGLER likened them to "two women, very different; Haarlem is beautiful, superior, but proud, hard, strong-willed; Gouda is sweet, amiable, tractable, in a word, she is my mistress." The design of the Gouda organ does not reflect the usual Dutch divisions (Hoofdwerk, Bovenwerk, Pedal) in the main case. The organ in Ezinge (ca. 1750) can be ascribed to Moreau, while the organ at Baarland (ca. 1750) was probably built by him with the help of his son Johannes Jacobus (Jan, chris. 16 Oct 1729; d. after 1764).

After Jacob François's death, Jan Moreau and Louis Delhaye, Jr., continued the business. Two church organs by Jan survive: Oosterhout (1753) and Rotterdam (Presbyterian Church, 1754, now in Gameren). In 1764, Jan Moreau moved to Middelburg. Louis Delhaye, Jr., continued the business on his own and built the surviving organs in Bergen op Zoom (1771) and Gouda (Waalse Kerk, 1772, now in Moordrecht).

JAN-PIET KNIJFF

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MORSS, RICHARD P(IKE) (1812–1860)

American organbuilder, also spelled Morse. Born in Newburyport, Massachusetts, the son of a local minister, Morss probably received some training in the nearby workshop of Joseph ALLEY, although he claimed to be self-taught. At age fourteen Morss became organist of his father's church (St. Paul's), which then had a small four-stop chamber organ purchased from King's Chapel, Boston, in 1756.

In 1833 Morss built his first organ, a one-manual instrument, for St. Paul's. Taking the old organ in trade, he rebuilt it with a new case and action for St. John's, Portsmouth, New Hampshire. This organ is one of two surviving Morss instruments; the other (1/6) is now in the Historical Society of Seabrook, New Hampshire. No record has been found of the extent of Morss's work, but he is known to have built at least a half-dozen organs, mostly in the lower Merrimack River area. By the 1850s Morss appears to have given up building organs, and is listed as an "organ and piano forte tuner" in city directories from 1855 to 1860. His trade in this line extended as far west as Haverhill, Massachusetts, and as far north as Augusta and Portland, Maine, where he died.

BARBARA OWEN

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MORTIER

Belgian manufacturer of ORCHESTRIONS. The firm was founded by Theophile Mortier (1855–1944), originally a dockworker at the port of Antwerp. According to some authors, Mortier established himself in 1879 as an organbuilder; this seems highly improbable, for he would have lacked the necessary funds. This, however, changed when around 1887 he married a wealthy woman almost thirty years older than he.

The couple operated a café with a dance floor. In order to save money on a small music ensemble, Mortier ordered an orchestrion by A. Gavioli in Paris. Each time he ordered a newer one he sold the previous instrument to fellow café owners. He then had his daughters learn the trade of making "books" (encoding the music to be heard on the orchestrion) in Paris with Gavioli. Once they had returned, Mortier started copying Gavioli's organs, for which he was sued in court and condemned to buy twelve organs a year by Gavioli; but Gavioli could not provide these in time, which freed Mortier from the court order. Although Mortier never knew anything about the orchestrion himself, by 1920 he had a factory of sixty to eighty workmen; his instruments soon gained a reputation for the good quality of the organ itself and even more for the very beautiful decoration on the front. About 1950 the firm closed, having made about fourteen hundred orchestrions.

See also **Mechanical organs**

FERDINAND J. DE HEN

MOSENGEL, JOHANN JOSUA (1663–1731)

Prominent East Prussian organbuilder of the Baroque era. Mosengel, probably born in Eisenach, Thuringia, on 16 September 1663, was likely a pupil of Tobias Heinrich Gottfried TROST and of Martin Vater of Hannover. After a brief period of work in Hannover, he settled in Königsberg (now Kaliningrad, Russia) and was licensed in 1690.

The specification of Mosengel's organ in Königsberg Cathedral (1710; 3/62) survives in the original contract. Mosengel incorporated several pipes from the extant organ (Zickermann, 1507). The WINDCHESTS, TRACKER action, and organ CASE were new. The disposition breaks down as follows: Hauptwerk (second manual), eighteen stops, including a Principal 16' "made of English tin," Rausch Quint 3', Mixtur VIII-X, and five different Flutes; Oberpositiv (first manual), twelve stops, with a Scharf Quint 3' and Mixtur IV-V; Brustpositiv (third manual), fifteen stops, including a Jula 8', Cimbel-Mixtur III, and Vox Curiosa 16'; and Pedal, seventen stops, featuring a Posaune 32', Quintaden Scharff 4', Zink II-III, Mixtur VI-VIII, and the noteworthy 8' "Feld Tromet von weissem Blech ins

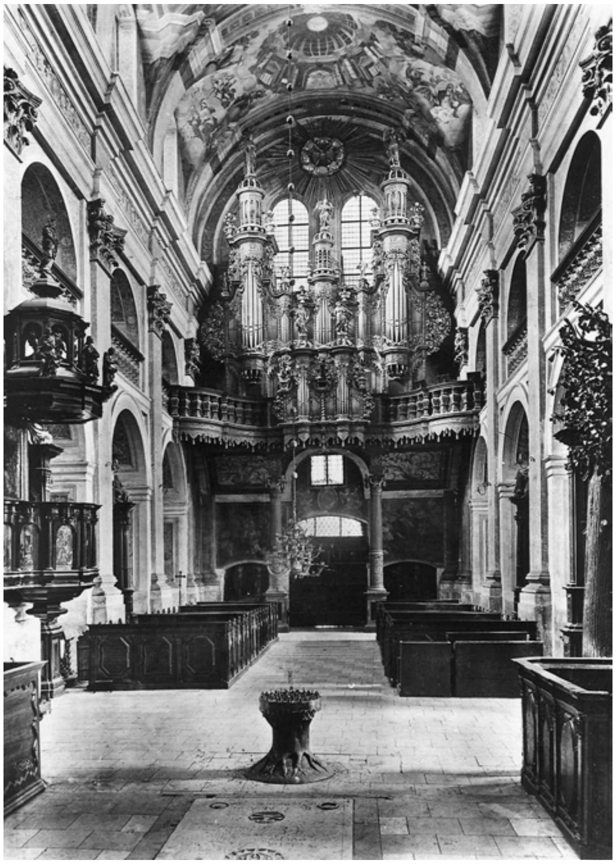

Fig. 59. Mosengel organ, 1721 (3/30), Heiligelinde (now Swieta Lipka, Poland).

Gesicht" (field trumpet [made] of white metal [located] in the facade). All three manuals have a Tertz 1-4/5'; all divisions have at least two reed stops. The instrument's extra stops included a Pauken, Vogelgesang, Tremulant (manuals and pedal), Zimbelstern, a flying eagle, and a moving angel. There were separate pallets (ventils) for each division and a "main Ventil" to close all at once. The short octave was still commonplace; originally, the manuals had a compass of C-a'' (without C♯, D♯, F♯, G♯, or g♯''), and the pedalboard had C-d' (without C♯, D♯, F♯, or G♯). A fourth manual was added, possibly by Johann Preuss (ca. 1757; 4/76), producing one of the largest organs of its time. In 1888 Max TERLETZKI rebuilt the organ in the old case with new cone-chests and BARKER LEVER action. In 1907 Carl Novak converted the organ to pneumatic action; in 1928 Furtwängler and HAMMER added an electro-pneumatic action. In 1945, the Mosengel organ, with its original case and later changes, was destroyed.

A small organ for Pörschken (1706) was typical of Mosengel's one-small instruments: Principal 4' (tin), Gedecktflöte 8', Quint 3', Octav 2', Sesquialtera 1-3/5' (metal), Mixtur III (1'), Spielflöte 4', Trompet 8', Bordun 16' ("ten pipes made of wood, the other thirty-five of metal"), and Gemshorn 2' (metal). A Pedal with three stops was added around 1850; considered one of the best of Mosengel's mostly intact organs, it too was destroyed around 1945. In all, his Königsberg workshop built thirty-seven new organs (partly with older pipes) and undertook twenty-two substantial rebuilds, including the addition of pedalboards. Until 1944, nine nearly complete and two partly original organs remained; twenty-six of his cases were still in existence. However, only five contracts and the rebuilt organ in Heiligelinde (Swieta Lipka, Poland; 3/30) survived World War II. His work in what is now Russia has apparently disappeared entirely.

Mosengel's most prominent pupil and colleague was Georg Sigismund Caspari. In 1721 he married Mosengel's daughter, and took over the Königsberg workshop upon Mosengel's death on 18 January 1731. After Caspari's death in 1741, the workshop was headed by his cousin, Adam Gottlieb CASPARINI, until 1788.

See also **East Prussia**

JAN JANCA

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MOUNTED (CHEST, RANK, STOP)

Description of the placement of a stop's RANK on its own CHEST above the HAUPTWERK. While this might increase the sense of height and depth, or even promote a military or religious idea, the mounted chest is used primarily to economize on space. The Cornet 8' is a common beneficiary of this approach. The mounted rank resembles a SOLO or HALF-STOP in its treble compass (from c'). In the classical French organ, Cornets were sometimes mounted but not so labeled; the RÉCIT and ECHO divisions could receive a similar treatment. The mounted chest should not be confused with the more dramatic EN CHAMADE REEDS, in which upper-chest pipes face the front horizontally, their open end projecting directly into the audience.

MOUTH

The open section of a FLUE pipe, between the FOOT (including the TOE) and body (RESONATOR), in which the sound is produced. (The term *resonator*, while usually applied to reed pipes only, is sometimes also used for the upper part of a flue pipe.) Continuing the organ-building analogy with the human body, the foot and body are joined; at this point an opening (the mouth) is cut in what will be the pipe's front.

In wooden pipes, the foot leads into an air passage called the WINDWAY, created by two smaller pieces of wood: the cap (lower front part of the face) and the block (attached at the back interior of the body), which is as wide as the pipe's interior cross section. A small amount of material is removed from the face where it would otherwise be in contact with the block, creating a thin gap between the top of the cap (lower lip) and the block. The pressurized air can now move from the foot through the windway, past the THROAT (just behind the cap) and through the narrow and shallow gap (flue), which creates the thin sheet of wind that will strike the upper lip. In metal pipes (naturally more malleable than wooden pipes), the foot expands from its small base (toe hole) to the juncture with the body, where an inset plane (face) covers the join. The mouth is cut into the face above an internal horizontal plate (LANGUID, replacing the box). Pressurized air travels through the foot, exiting through the narrow opening created by the lower lip and the languid (flue, sometimes called windway) and sent in a flat sheet toward the sharp-edged upper lip.

RICHARD KASSEL

MOUTH ORGAN

Two different free-reed instruments, one Eastern, the other Western. The older type by far is the Asiatic *khène*, represented already on the bronze gongs of the paleolithic Dong Song culture. It consists of a series of bamboo pipes, fixed circularly in a gourd, the neck of which serves as a mouthpiece, the body being the windchest. Each pipe has two holes, one inside the body and one just outside it. The lower one is covered by a thin metal tongue acting as a free reed. This reed is not as flexible as those used in the European REGAL; thus, more air pressure is needed, accomplished in the windchest-body by covering up the upper hole with a finger. Sometimes the pipes are fixed in two rows, in which case the gourd is replaced by a small wooden body. The number of pipes varies from three (the *kledi* from Borneo) up to more than 13. The length of the pipes varies widely, from about 16" to more than 6'.

Chinese tradition describes the instrument; its first known mention dates to about 1100 BCE, whereas the oldest Chinese representation of the instrument dates from 551 CE. The mouth organ became a classical instrument in China (*shêng*) as well as in Japan (*shô*), where it is still played in *gagaku* (ritual court music). In this case, the melody is played in the lower voice, the eleven or so chords above it.

In 1777, the working principles behind the Chinese *shêng* was introduced in Europe through the writings of the French Jesuit Jean-Joseph Amiot (1718–1793), who had served in Beijing. The German academic Christian Gottlob KRATZENSTEIN was carrying out experiments with free reeds at this time, although his interests lay more in phonetics and the invention of a "speaking machine." Numerous musical experiments with free reeds were made, mainly in Germany. These led to the invention of the Mundharmonika (mouth organ) by Friedrich Buschmann in 1821; he called his instrument the Mundäoline. It became rapidly popular: it was easy to learn to play, small, and inexpensive.

In the *harmonica* (the common English name for the mouth organ; another, more slangy term is *harp*), alternating blowing and inhaling air produces two notes on the same blowing hole. This principle applies to other handheld free-reed instruments (accordion, concertina, bandoneon), even when the winding is accomplished by hand motion rather than breathing in and out.

There are two main types, diatonic and chromatic mouth organs. In principle there always is only one free reed per note, although the number of reeds can vary. In a chromatic instrument there are usually twelve blowing holes and forty-eight reeds although more are possible. The simplest form is the so-called Richter type, with one row of free reeds; the more complicated Vamper type uses two rows, tuning slightly differently from one another, producing some vibrato. In the chromatic mouth organ there are two rows of reeds with a semitone difference. A slider shifts the desired row into place. The mouth organ is used in popular music, jazz (e.g., Jean "Toots" Thielemans), and classical music (e.g., works by Darius Milhaud and Matyas Seiber).

FERDINAND J. DE HEN

MÜLLER, ABEL

See ROOSEVELT, HILBORNE L.

MÜLLER, (JOHANN) CHRISTIAN

Dutch organbuilder of German birth. Müller was born in Andreasberg, Harz, on 4 February 1690. He moved to Amsterdam sometime after 1715 and became an apprentice of Cornelis Hoornbeeck (d. 1722); both worked on Amsterdam, St. John's Cathedral, in 1718, Müller (with Rudolph Garrelts) in 1722. Taking over Hoornbeeck's workshop, Müller's reputation was initially made by the organ at Leeuwarden, Cathedral (Jacobijnerkerk) (1724–27; 3/37/pull-down; rest. Bakker and Timmenga, 1978). He built an instrument in the 1680 Langlez case at Amsterdam, Waalsekerk (1733–34, 2/22/pull-down; rest. Ahrend and Brunzema, 1963–65) and repaired the Hagerbeer/Schnitger organ at Alkmaar, St. Laurenskerk in 1734 and again in 1751 (3/56; destr. 1760). Müller was best-known for his well-constructed instrument at Haarlem, St. Bavo's Cathedral (1735–38, 3/61, metal pipes only, diagonal bellows; rest. Marcussen, 1959–61, and Flentrop, 1961).

With his national reputation secured, Müller built organs throughout Holland and Frisia (West Friesland), including: Zaandam, Lutheran Church (1737); Bennebroek (1742); Amsterdam, Engelse Kerk op het Begijnhof (1753; 2/14/pull-down; reb. Flaes, 1874; repl. Flentrop, 1998); and Beverwijk, Reformed Church (1756; 2/22/pull-down). His final large instrument, at Alkmaar, Kapelkerk (Lutheran), 1762 (2/19/pull-down; rest. Jongepier, 2001, now 2/23), was built with his son Pieter (chris. Amsterdam, 27 May 1738; d. after 1789), who later built harpsichords. The elder Müller died on 8 March 1763, and was buried in Amsterdam.

Müller, who also built smaller instruments (Westerbork, Reformed Church, 1725–26, 1/7; rest. de Graaf, 1983–87) and cabinet organs, represents a highpoint of the German-influenced Dutch Baroque. His focus on foundation stops and mixtures (but relatively few aliquots) balances German and Dutch elements, although his standardized scalings and limited, undifferentiated tonal variety have met with criticism. Müller's work was continued by Johann Heinrich Hartmann BÄTZ. A relative, Johann Caspar Müller (b. 23 July 1697; d. 1746), worked with Christian until 1729. His most significant independent work was the enlargement of the 1724 Christian Vater organ at

Amsterdam, Oude Kerk, 1738–42 (3/53; reb. Witte; 1869; rest. Blank, 1988; now 3/55).

Richard Kassel

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MULTIPLEX

See Extension Organ

MUNDT, JOHANN HEINRICH (CA. 1632–1691)

German-born organbuilder, active in Bohemia. Born in Cologne (chris. 15 Nov 1632), Mundt traveled to Prague during his time as a journeyman and began working with Hieronymus Artmann. The first organ wholly attributed to him was built for St. Thomas Church in the city's Little Quarter (1668). Between 1668 and 1670 he built a new organ for Osek, Abbey Church (2/26). In 1670 he began work on what was to become his best-known instrument, the organ for Prague, Týn Church of Our Lady; it was modified in 1673 and 1682 (2/29; rest. Klais, 2000). Other organs by Mundt include: Kralovice, St. Peter and Paul, choir organ (1671–84; orig. Plasy, Cistercian Abbey; extant); Vyšší Brod, Cistercian Abbey (2/29; dism. and partly extant); Prague, St. Wenzel (1684); Prague, St. Nikolai (1685; 1/13); Prague Old City, Benedictine Abbey (1685); and Velvary, Cemetery Church of St. Georg (1689, 1/10; orig. Velvary, City Church; extant). He died in Prague on 18 March 1691.

Mundt was one of the leading Bohemian builders of the seventeenth century. The Týn Church specification exemplifies his tonal designs: Manual: Principal 8', Bourdonflauta 16', Copula major 8', Flauta dulcis 8', Salicional 8', Quintadena 8', Octava 4', Quinta 3', Superoctava 2', Quintadecima 1-1/2', Sedecima 1', Cembalo 1', Mixtura 1', Copula minor 4'; Positiv: Principal 4', Octava 2', Quinta 1-1/2', Quintadecima 1', Rauschquinta 1/2', Mixtura 2/3', Copula major 8', Flauta amabilis 4'; Pedal: Open Subbass 16', Stopped Subbass 16', Octavbass 8', Quinta 6', Superoctav 4', Mixtura 2', Posaunbass 8' (Schnarrbass), and two Cymbelsterns. His instruments usually include fewer mutations and reeds than in their German counterparts; prominent tin pipes; inclusion of Italian elements; an 8' Copula with thin-walled oak pipes that produce a cross between a Principal and a Flute; and inclusion of the Tierce in mixtures.

Douglas E. Bush

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MUSETTE

A reed stop of 8' or 4' pitch, imitating more or less the instrument of the same name, a small bagpipe. Its pipes have been made in a number of forms, some employing free reeds, and some beating reeds, with resonators of conical, cylindrical, and inverted conical shape, anywhere from one-half to one-eighth the normal speaking length. The tone of the Musette is generally quiet and thin. The stop was known at least as early as the middle of the eighteenth century.
See also **Stop**

Edward L. Stauff

MUTATION

In present usage, a single or multirank stop pitched at nonoctave upper partials, in overtone series order: fifths (e.g., Twelfth, Nineteenth), thirds (Seventeenth), sevenths (Twenty-first), and ninths (Twenty-third). The term, which is of uncertain origin, was introduced in the nineteenth century. Usually a wide-scaled Flute, mutations based on the 8' fundamental include the Nasard (Twelfth, 2-2/3'), Larigot (Nineteenth, 1-1/3'), Tierce (Seventeenth, 1-3/5'), and None (Twenty-third, 8/9'). The Septième (Twenty-first, 1-1/7') is the natural seventh partial, located between the major sixth and minor seventh above the fundamental (plus two octaves), and untempered; Aristide Cavaillé-Coll and other French builders used the stop to intensify mixtures. Historically, the term is ambiguous: a synonym for “stop,” “registration” (*jeux*), or, in the French classical organ, *le mutations* were those ranks outside the Plein Jeu chorus (thus including the 2' flute, even reeds). The common English interpretation, that a mutation represents a change of the fundamental to the partial involved, is incorrect; in registration, a mutation remains a component of its fundamental, and is employed for specific purposes. (Mutations are not mixtures, which involve more than one rank and pitch.)

MARCO TIELLA

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MUTIN, CHARLES (1861–1931)

French organbuilder. Mutin was born in St. Julien-sur-Suran, Jura, on 7 April 1861. His family moved to Paris after the Franco-Prussian War (1869–70). His mother placed him in apprenticeship with Aristide CAVAILLÉ-COLL in 1875, working under Joseph Koenig (1846–1926). Although he was a good student, Mutin was entering a trade that had begun to decline, in part because of a post–Second Empire backlash toward the church in France. Nonetheless, Mutin became increasingly important in the Cavaillé-Coll firm; by the early 1890s he was running it on a day-to-day basis, and purchased the company a year before Cavaillé-Coll's death in 1899.

Mutin's instruments were initially sold under the Cavaillé-Coll name; later, he expanded it to Cavaillé-Coll–Mutin. The memories and reputation of the founder was obviously useful selling tools, but the new century brought electro-pneumatics, a technology Cavaillé-Coll was reluctant to accept, to the fore. While Mutin adapted to new conditions, his old-fashioned approach proved economically difficult to sustain; attempts to use less good materials to achieve familiar results were not successful. The French Romantic palette of mutations and mixtures were increasingly replaced by less colorful, more international tonal qualities. There were other factors: the devastation of World War I, and the early effects of the ORGAN REFORM MOVEMENT. By 1924, Mutin had passed the firm on to August Convers, whose mass-production methods and faulty electrical systems alienated customers to the point of his dismissal in 1928. By the time of Mutin's death on 29 May 1931, the company was in the last decade of existence, essentially irrelevant to the French organ-building scene.

Mutin continued the Cavaillé-Coll pattern of building larger church organs and two-manual residence organs. Among his works are: Péruwelz (Belgium), Catholic Church (1898; 2/9); Paris, St.-Augustin, choir organ (1899; 2/30; rest. Gonzalez, 1973, rest. Dargassies, 1983; electric); Meudon, A. Guilmant residence (1899–1900; 3/28; to M. Dupré residence, 1926; reb. Beuchet, 1932; electric); Neuilly-sur-Seine, St.-Pierre (1900; 3/53; pneum., Barker lever); Patin (1901; 2/15; rest. N. Toussaint, 1988; now 2/20, mech.); Paris, Schola Cantorum (1901; rest. Beuchet-Debièrre, 1967; now 3/31); Metz, St.-Eucaire (1902; 2/22); Metz, Notre-Dame (reb. 1730 J. Nollet/1846 A. Sauvage organ, 1903; 3/38; rest. Aubertin, 1983); Farnborough, England, St. Michael (1904; 2/17; rest. Klais, 2002); Paris, Sacré Coeur de Montmartre, main organ (enl. 1898 Cavaillé-Coll, 1919; 4/67; rest. Renaud, 1985; 4/78; mech.) and choir organ (1914; 2/21; mech.; rest. Renaud, 1980); Guebwiller, Notre-Dame (1908; 3/45); Marseille, Les Chartreux (1911; 3/32; rest. 1984); Lille, St.-Maxellende (1913; La Turbie, St.-Michael, 1915; 2/9; rest. 1995); Monaco Cathedral (1922; 3/50; reb. Puget, 1951; electric; repl. Boisseau, 1976–78); Douai, St.-Pierre (1922; 4/67); Capdenac, Notre-Dame (1926; 2/13; rest. Baoissonnade, 1987); and Wassenaar, Dorpskerk (relocated 1936; 2/14; dism. 1996).

Like Cavaillé-Coll, Mutin instruments frequently found their way into foreign markets, most having been opened up by his predecessor. Spain was the beneficiary of at least two organs: Usurbil, Guipúzcoa, Parroquia del Salvador (1907; 2/30) and Lecaroz, Navarra, Capuchinos convent (1922; 2/23). Rome's Argentine National Church has a Cavaillé-Coll–Mutin instrument. Algeria and Tunisia had each received a small Cavaillé-Coll organ; Mutin built six for Algeria, of which two have survived, including the recently restored instrument at Basilique Notre Dame d'Afrique in Algiers (*see* Africa). But the most significant foreign market was South America: at least nineteen organs in Argentina, of which more than half were located in Buenos Aires; two in the Rio de Janeiro region of Brazil; and two in Venezuela.

RICHARD KASSEL

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N

NACHTHORN

A term applied to least three different stops.

(1) The earliest and least common types dates from the 1500s, when it was a type of Cornet mixture, especially in the Netherlands and northern France.

(2) Most common today is an open Flute of very wide scale (wider than any other stop, according to some). It generally has a low, narrow mouth, which gives it a soft voice in spite of its large scale. It was used as a solo stop in either manual or pedal.

(3) The other common form is a stopped Flute of very wide scale, a cross between a Quintaten and a Gedeckt, having a tone that some describe as hornlike. It was found at 4’ and 2’ pitch, and made of wood or metal. It dates from around 1600, but was used into the twentieth century by Skinner and others. This form is also known as Cor de Nuit. Other forms include a slightly conical, large-scale Rohrflöte with small chimneys, and even a reed.

See also **Stop**

Edward L. Stauff

NASARD/NAZARD/NASAT

See Twelfth/Nasard/Nazard/Nasat

NASON

A stopped wooden flute stop of 8' or 4' pitch. Its tone, like that of the Quintaten, contains a significant amount of the third partial, and has been described as sweet, soft, round, pervading, and mysterious. It was used by North German builders during the seventeenth and eighteenth centuries, and was introduced to England at the end of the seventeenth century. It has sometimes been made with chimneys. Nason Flute, Nasonflöte, and Nason Gedeckt are synonyms.

See also **Stop**

Edward L. Stauff

NEOCLASSICAL ORGAN

After Albert Schweitzer instigated what became the Organ Reform Movement in Germany with his articles “The Art of French and German Organ Building and Playing” (1905–6), builders of symphonic Romantic instruments were increasingly pressured to make their instruments appropriate for the music of Johann Sebastian Bach, whose contrapuntal lines tended to disappear into the lush, foundation-based sonorities of late Romantic organs. For Schweitzer, the gains in technology of the late nineteenth century had come at a considerable musical price, a concept he concretized at a 1909 Vienna conference as a set of principles. What was first known as the Alsatian Reform Movement (Schweitzer was a native from that area of changing nationalities) spread throughout Germany to the extent that, by the 1920s, organists were insisting on Bach as the musical test of any new instrument. Ironically, Schweitzer favored French builders, especially Aristide Cavaillé-Coll, who he believed had maintained closer ties with tradition; to Schweitzer, Bach was eminently playable on the tonally beautiful Cavaillé-Coll organs, despite their remove from the Schnitger and Silbermann organs Bach knew. A 1926 conference in Freiberg tied the reform movement to a renewed interest in church liturgy and music, and gave a strong Germanic tone to what had previously been a rather localized movement.

Whatever the hope was for a unified approach, this did not occur; rather, two paths of reform emerged. One might be called antiquarian, revivalist, authentic, or (often) neobaroque: the re-creation of the sound and look of sixteenth-, seventeenth-, and eighteenth-century instruments. This process, the explicit goal of the original reform movement, has dominated European organ building since shortly after World War II, and has become more or less the North American standard. But the achievement of that goal proved far more difficult than expected. It was not until a 1969 Schnitger conference in Groningen, Netherlands, that would-be builders realized that creating an instrument with the right disposition, mechanical action, manual blowing, and old-style case was not enough. The pipework had to be closely studied as well as its placement in the various divisions and couplings; the Töpfer scaling standardization of the nineteenth century would not produce the desired sonorities. Restoring older instruments went a long way toward teaching new builders old ways, but the art of resurrecting the older type of organ could not risk becoming formulaic.

The other path attempted to reconcile the organ technology of the 1920s, the growing interest in organ literature from all areas, and a respect for the distinctive sonorities associated with these literatures. This seemingly impossible task was realized in the neoclassical organ, an eclectic instrument capable in theory of playing both French and German organ music of the Baroque and Renaissance (at least), yet retaining the benefits of electro-pneumatic action and other then-recent technological innovations. During the period between 1930 and 1960, many builders dispensed with cases and made visually intriguing, often asymmetrical placement of pipes a goal onto itself. In the United States, the apex of this approach became known as "American classic," and its leading proponents were G. Donald HARRISON and Walter HOLTKAMP.

If the neoclassical aesthetic means taking older ideas and viewing them through new eyes to produce a new synthesis, then this term applies to these organs—but not the music associated with them. The best composers remained faithful to the sonorities they knew (Olivier Messiaen) or the liturgical setting they worked in (Hugo Distler); there was no major organ school that depended on the neoclassical organ per se. Other builders who contributed to the neoclassical organ—who at some point mixed traditional dispositions with newer technology—include CASAVANT FRÈRES, CHARLES B. FISK, THEODOR FROBENIUS, VICTOR GONZALEZ, HARRISON AND HARRISON, OTTO HOFMANN, MARCUSSEN AND SON, FRITZ NOACK, LAWRENCE I. PHELPS, RIEGER, WILHELM SAUER, SCHLICKER, VISSER-ROWLAND, AND VLEUGELS.

RICHARD KASSEL

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NETHERLANDS

SEE LOW COUNTRIES

NEW ZEALAND

Colonial Imports: England and Beyond

One of the most distant bastions of the British Empire geographically, New Zealand was colonized steadily, not only by settlers from Britain, but by immigrants from elsewhere in Europe. The historical organs of New Zealand date almost exclusively from the latter part of Queen Victoria's reign. The first instrument to arrive (1830) was a four-stop barrel organ by A. Buckingham, London. Used by the prominent church missionary Henry Williams, it now rests in the Wanganui Museum. A second barrel organ arrived in 1834 (Bates, three stops).

A 1779 Avery instrument stands in the Ponsonby, Auckland, Baptist Church, said to be a gift from Queen Victoria to Bishop Selwyn. Despite several detrimental alterations, it retains many Avery features such as the GG long compass. Another legendary organ is the 1712 Renatus HARRIS instrument first installed in Baschurch, All Saints, and later installed in Te Aroha, St. Mark's (North Island). It was restored in 1985.

Throughout the nineteenth century, church organs by the primary English builders arrived in New Zealand. The Anglicans were very prominent in the latter part of the century and split into familiar camps: those desiring liturgical enrichment (pro-organ) and those against it. This factor combined with a more buoyant economy in some regions allowed several substantial instruments from prominent English firms to be imported. The Roman Catholic Church was much slower to utilize pipe organs and most installations belong to the first decade of the twentieth century. The Methodists acquired organs where possible to assist in their dependence on hymnody. The Presbyterians went through their organless period, but the Presbyterian Mother Church, First Church, in Dunedin, broke ground by installing a three-manual Halmshaw instrument in 1888. By the last years of the century, the pipe organ, Reed Organ, and harmonium became part of the musical scene as choirs and choral societies proliferated.

The comparatively late settlement of New Zealand (1840, becomes crown colony; 1907, Dominion status) meant that the range of historic organs is more limited than Australia. Although builders such as Bevington provided fine instruments of classical design, many instruments were influenced by the experiments and renovations of a later age. Some truly significant Victorian and Edwardian instruments exist to this day, some of international importance. Auckland, St. Matthew's, obtained a two-manual Willis reputed to be part of its organ for the Great Exhibition of 1851 at the Crystal Palace.

In addition to those already mentioned, instruments were commissioned from Bishop, Brindley and Foster, Bryceson, Gray and Davison, William Hill, Hunter, Henry Jones, Alfred Monk, Ingram, Nicholson and Lord, Norman and Beard, Positive Organ, T. C. Lewis, Telford and Telford (Dublin), Wadsworth, and Walker. The American Jardine firm was also commissioned. There are no definitively identified examples of continental European instruments apart from French harmoniums, although some pipework by Schulze may survive in one or two organs.

Australia has been a relatively small exporter of organs to New Zealand. George Fincham built several organs that were installed by his partner, Arthur Hobday. Josiah E. Dodd, who worked in South Australia, epitomized the late Romantic approach of the early twentieth century. He exported two organs to Napier, South Island. The smaller of the two survives; the much more lavish example for St. John's Cathedral (1907) was destroyed in the great earthquake of 1931.

Organs Built in New Zealand

For a small country, New Zealand has always enjoyed a lively organ-building scene. Several local builders trained overseas, and were eager to prove their ability in their adopted home. Alfred Brake worked on the North Island, obtaining parts and pipework from Laukhuff of Weikersheim, Germany. His organs are of unusual and interesting tonal design, with skillfully voiced wooden pipework. Herbert Brett was trained by Eustace Ingram and traveled to Christchurch to install an Ingram organ in His Majesty's Theatre (1908; destr. 1917). He undertook the refurbishment and rebuilding of several local organs. George Croft came to New Zealand as an infant. He returned to England in 1910 where he worked with Hill and Son, and may have acted as a foreman to George Benson, Manchester. Upon returning to Auckland he established a solid enterprise (later known as George Croft and Son) and built or rebuilt a substantial number of instruments in both islands. Christopher Farrell came from Telford and Telford. He installed two new organs and built two others based on existing material.

The aforementioned Hobday was an apprentice of George Fincham, who became his partner. He acted as Fincham's agent in New Zealand, but his procrastination over the assembly of Fincham organs caused the partnership to be dissolved. He built many organs under his own name, becoming the leading builder and rebuilder in the Wellington-Malborough area (much as Croft was to Auckland). His earlier church organs are bright and flexible, and the instruments for the Roman Catholic basilicas of Timaru and Wellington show the high degree of skill he exercised when working on a grander scale. He was, however, too greatly influenced by "Klangfarbe" trends, deemphasizing the chorus ensemble in favor of highly colorful solo stops. Upon his death, his son, Arthur A. Hobday, succeeded him for around two years.

Edgar H. Jenkins trained with Hill in London. He left in 1858 to work with Aristide Cavaillé-Coll in Paris, installing an organ in San Sebastian, Spain. Jenkins later settled in New Zealand. His reversed console, mechanical action instrument in the Methodist Church, Lyttelton, shows some French influence. N. T. Pearce was born in Cornwall, England, and trained with Ingram. He eventually emigrated to Christchurch where he was a prolific builder; many of his instruments are aesthetically pleasing and bold and clear in voicing. William Webster was a colonist who settled in the Hokianga district of Auckland, an important harbor for the milling of timber. Webster constructed a four-stop chamber organ made of local woods and ivory for the keyboard; built in 1850, it was the first organ built in New Zealand. Stylistically prophetic of an English chamber organ of the mid-1880s, it stands in the New Zealand Furniture Room of the Dominion Museum, Auckland (rest. Bruce Thompson, 1986).

The Post–World War II Revival

At first, there was little stimulus to improve instruments. The Aberdeen firm of Lawton and Osborne succeeded Croft and Son as the most prominent New

Zealand firm. It rebuilt the Lewis/Hobday organ in St. Paul's Cathedral, Wellington (1946) in a historically sympathetic manner. In the early 1950s several instruments were imported from the English firm of Hele and Company, Plymouth. Wellington received the first two inklings of the Australian ORGAN REFORM MOVEMENT. The Werner Bosch two-manual tracker instrument at the Elizabeth Street Chapel (1958) was followed that year by the groundbreaking new organ by Croft and Son at St. Mary of the Angels. Here, Schulze-type Diapason choruses, French-styled Swell reeds and properly scaled mutations combined to produce an eclectic, neoclassical instrument that nurtured a new school of organ playing. Other church organs were altered in emulation; new instruments were also modeled on this type but without the proper acoustical environment, scaling, or organists' input. Croft and Son, under the direction of Bill Croft and later Ken Aplin, produced new electric-action instruments with new pipe forms and imitative Baroque voicing and tonal ideas. Many rebuilds were also developed along these lines.

In 1969 Croft and Son produced its first substantial mechanical action organ (Tamaki, Auckland, St. Thomas's) and set the scene for the classical (neobaroque) organ revival. The performing scene became more established as local organists heard recordings of notable foreign players (E. Power BIGGS, Ralph Downes, Lionel Rogg, Helmut Walcha) and traveled overseas to enrich the local scene with new ideas. Croft and Son built fifteen more neobaroque instruments, with prominent examples for Auckland, St. Patrick's Cathedral; Canterbury University; Rotorua, St. Luke's Church Center; and Christchurch, Rugby Street Methodist.

At this time a new organ-building enterprise emerged, the SOUTH ISLAND ORGAN COMPANY (SIOC). In order to survive in a narrow and economically risky market, they first undertook rebuilds and electrifications of old instruments; but with changes in directorship, the SIOC began to take a conservative (i.e., conservational) approach to organ work. In 1977 the SIOC produced a two-manual tracker instrument at Wellington, Old St. Paul's Cathedral. Around this time the firm started to implement a full restoration policy on Victorian organs such as the three-manual Halmshaw at Christchurch, Blessed Sacrament Cathedral (1878).

By the 1980s, SIOC and Croft and Sons were diametrically opposed in philosophy and interpretation toward organ building; several fine instruments suffered alterations and additions at marked variance with their original character. In 1980 a movement was started by the author and others to found a conservation/preservation organization to bring attention to historic organs and intelligent organ craftsmanship. Organ thinking in New Zealand had been dominated by muddled thinking, as reflected in amateurish organ journals. This improved somewhat with the visit in 1981 of John Stiller, research officer to the ORGAN HISTORICAL TRUST OF AUSTRALIA under the auspices of an ANZAC fellowship scheme of the internal affairs department. He stayed for several months, investigated eighty instruments, and documented thirty-five. His work provided a basis for research and created a new awareness among organists, historians, and the general public, of the significance of the country's pipe organ heritage.

With the closing of Croft and Son in 1988, only SIOC remains as a major New Zealand organ-building firm. Its influence has spread to Australia. Recent significant restorations have included a 1906 four-manual Norman and Beard concert organ (Wellington Town Hall), 1912 Hobday organ (Timaru Basilica), 1906 Bishop/Norman and Beard organ (Christchurch, St. Lukes), and Hill and Son organ (Christchurch, St. Paul's Trinity). The two former directors of Croft and Son are now working independently in mostly organ maintenance. Bruce Thompson of Auckland produces continuo organs influenced by his former employer Fernand LÉTOURNEAU of Canada, which, although arguably limited, provide the benefits of precise and clear tracker action pipe speech. In 1992 a Dutch classical instrument by the REIL firm was installed in the Adam Concert Room of Victoria University. This joins the significant mechanical action organs of Canterbury University's School of Music and the McClaurin Chapel, University of Auckland.

MICHAEL A. COX

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NICKING

A technique for VOICING metal FLUE pipes, in which small *V*-shaped cuts are made in the edge of the lower LIP or the edge of the LANGUID (block) that together form the WINDWAY, where a sheet of wind emerges and is directed across the upper lip, causing air to vibrate within the pipe (and the pipe to sound). Nicking is designed to help adjust the pipe's speech and steady its tone; two undesirable elements are targeted: excessive CHIFF, and a snarling in the sound stream onomatopoetically known as "sizzle." The effect of nicking is to reduce harmonic content (partials) at initial articulation and the continuation of sound; the more nicking is applied, the less chiff and sizzle will occur. Nicking, along, with adjustments to the CUT-UP and the height of the languid relative to the bottom lip, are the principal means of voicing organ pipes.

Nicking has been a central point of contention among organbuilders for the last century. Historically, nicking was in use by the seventeenth century, but the aging and wearing down of pipes from that period make it difficult to assess the amount that was used. (It appears that Arp SCHNITGER, Gottfried SILBERMANN, and François-Henri CLIQUOT used nicking). The leaders of the early twentieth-century German ORGAN REFORM MOVEMENT interpreted the lack of evidence as evidence that Baroque builders must have made open pipes with minimal or no nicking, that the resulting chiff was ideal for contrapuntal music, and that this approach should be the model for twentieth-century builders of "authentic" Bach instruments.

In between the Baroque and twentieth century, the Romantic era began to reject the sharp articulation of unnicked open pipes; the increasing use of sustained notes discouraged snarling effects even more. The increase of WIND PRESSURE required that the greater amount of chiff and sizzle be offset. Nicking began to be much more important to voicing, whether the pipes were wide Diapasons with fewer partials, and therefore needed limited but deeper nicking to have an effect, or if they were narrow, harmonically complex string stops (e.g., Gambas), which required more, almost microscopic nicking, forming continuous serrated edges with tiny saw teeth. A rich, open tone with insignificant chiff was possible. By the late nineteenth century, builders and organists everywhere preferred the gentlest and swiftest of articulations, as if chiff had been eliminated. Electricity added to the possibility of realizing such sonic goals, especially tonal steadiness.

The ideals of the Orgelbewegung became the international standard immediately after World War II, with North American organists (and, somewhat later, builders) accepting the notion that nicking was to be avoided, altogether. Other issues arose, however: the absence of nicking improved chiff, but created more sizzle unless the windway was narrowed significantly; a narrower windway eliminated the sizzle, but weakened the overall tone quality. Light nicking began to reemerge as a means of offsetting this development. Finally, the historical claim that Baroque organs did not use nicking proved misleading. Indeed, the windways of the best surviving Baroque pipes were open, their edges unnicked, their sound free from sizzle. However, when present, notes Fisk, "the nicking, being itself an artistic ingredient, introduces a certain grainy quality, a shimmer, sometimes even a silvery quality, that is a specialty in itself." The neoromantic trends of recent years has seen renewed examination of the techniques of ARISTIDE CAVAILLÉ-COLL and his generation. Finally, as with any tonal issue involving the organ, the ear will serve as a better judge of sound than any doctrine.

RICHARD KASSEL

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NIEHOFF (NYHOFF)

Brabantine family of organbuilders, probably of Dutch origin. Other spellings include Neuhoff or Nieuwenhoff. Some scholars place them in Leeuwarden, others in Münster (Germany). The family worked in the Low Countries as well as in Franconia, the Rhineland, and Hesse in Germany.

Hendrik (Heinrich) Niehoff (ca. 1495–1560) was the most important member of the family. In Amsterdam, he learned the trade from Jan van COVELENS; together they built organs at Maastricht, St. Servaas (1525) and Kampen, St. Nicolaas (1527); Niehoff completed van Covelens's unfinished work after the latter's death in 1532. Niehoff began an itinerant life, with 's Hertogenbosch as his base. He traveled to Liège, where he was well-regarded enough to be sent by 's Hertogenbosch church officials to study organs. He returned and enlarged the organ at St. Jan (1538–39). At this time, he met Hans SUISSE; the two went into partnership to build the new main organ at Amsterdam, Oude Kerk, which Niehoff completed with the help of Hans van Coelen (1539–42, 1545). This is the instrument upon which the composer-organist Jan Pieterszoon Sweelinck would later play.

Thereafter, Niehoff repaired, enlarged, and built organs. His new instruments include Delft, Oude Kerk (1545); Tongerloo Abbey (1543); Amsterdam, Oude Kerk, small organ (1544–45); Enkhuizen, Grote of Westerkerk (1547); Delft, Nieuwe Kerk (1548); Zierikzee (1548); Hamburg, St. Petri (reb., 1548–50; 3/28, including Blockwerk division); Lüneburg, St.

Johannes (1551–52; described by Praetorius); Bergen op Zoom (1555); Gouda, St. Jan (1555–56; repl. J.-F. Moreau, 1732–36); and Rotterdam, Laurenskerk, small organ (1560; reb. J.-F. Moreau, 1720–22; now Rotterdam, Prinsekerk).

Hendrik's brother Hermann Niehoff (ca. 1495–after 1546) worked with him, as did his son Nikolaas (Nikolaus) Niehoff (ca. 1525–ca. 1604). Nikolaas, who worked on organs at Cologne (St. Gereon, 1573; collab. Lampeler van Mill) and Mainz, continued his father's workshop. Another son, Jacob Niehoff (1565–1626), built the organ at Würzburg Cathedral.

Hendrik Niehoff fused new German and Swiss organ-building techniques with the contemporary Brabantine organ developed by van Covelen, whose contribution to it had been was the use of wide-scaled pipes. The general outline of Niehoff's organs, models for later builders, consists of a Hoofdwerk (Diapason, Mixture, and Scherp), Bovenwerk (mainly Flutes and reeds), Rugpositief, and Pedal (Trompet 8' and Flute 2', but no 16' stops).

Ferdinand J. De Hen

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NIEMANN, HENRY (1838–1899)

German-born American organbuilder, also active in Europe. Born in Osnabruck on 27 April 1838, Niemann trained as a cabinetmaker. In 1857, he emigrated to the United States and worked for John Closs (1823–1896) in Cincinnati. Two years later, he moved to England, where he worked with Charles S. Barker, inventor of the Barker lever. In 1862, Niemann went to work for Aristide Cavaillé–Coll in Paris. From 1872, he worked in Baltimore, where he manufactured about 150 instruments, forty for the churches of Baltimore; he died there on 26 1899. His son, Frank H. Niemann, became his successor, and the firm operated until 1908.

In general, Niemann organs were characterized by durable craftsmanship, bold voicing, and simple casework, as shown in the organs that survive, including (all in Baltimore): St. Leo's (1881), the chapel of St. Joseph's Passionist Monastery (ca. 1887), First Unitarian (1893), and St. Peter the Apostle (ca. 1893).

Stephen L. Pinel

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NIGERIA

The role of the pipe organ in Africa is tied to the presence of Christianity, a crucial component of colonization. In the case of the future Nigeria (an amalgam of British-held territories), Christianity became fully established around 1850 with the influx of Anglican, Baptist, Catholic, and Methodist missionaries from England and the United States. These missionaries settled mostly in the Yoruba and Igbo areas, where churches were built for the new congregations. Nigerians were first introduced to singing European hymn tunes accompanied with harmonium, piano, and later pipe organ.

African independence caused Christianity to lose its sway in many areas, in part because the colonial powers were no longer able to sustain their perpetration culturally and financially, in part because Islam has made significant inroads from the Mediterranean south and now dominates northern Nigeria (eliminating musical instruments from worship). However, nations such as Nigeria (independence 1960; largest population in Africa) had enough Christians among the indigenous population to continue the use of organs in religious settings.

More than other African nations, Nigerian musical culture favored the continuing influence of Western music, while indigenous musics gained full respect and academic study. The most significant figure in the fusion of Nigerian and European styles was Fela Sowande (1905/06–1987), a composer, concert organist, and conductor who trained at the Royal College of Organists, London, and became the musical director of the Nigerian Broadcasting Service and honorary organist at the Anglican Cathedral Church of Christ in Lagos. His efforts laid the basis for a small but well-established coterie of organist-composers.

Among the pipe organs in Nigeria built in Europe include: Harrison and Harrison (Breadfruit/Lagos, St. Paul's, 1965, 3/49; Aroloya/Lagos, St. John's, 1985, 3/48); Oberlinger (Lagos, First Baptist Church, 2001, 2/15); and Mander (Warri, St. Andrew's Cathedral). Nigeria is also a source for two important materials used in organ building: tin and African ebony.

However, as with most of sub-Saharan Africa, the electronic organ has become predominant in Nigeria. Digital church organs by Allen (United States) and

Viscount (Italy) are distributed by the Chopin Music firm in Surulere, Lagos. Nigeria's popular musics, such as juju, highlife, and Afrobeat (Fela Kuti), have helped make the electronic organ a vital element of the African soundworld.

See also **Africa; South Africa**

GODWIN SADOH

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NIGHTINGALE

The Nightingale was a stop comprised of two or more small pipes whose ends are immersed in a vessel of water to create sounds that imitate the warbling of birds. This stop was very common in the organs of southern Italy, but was also known in other European countries from the middle of the fifteenth century onward. The stop was rejected in Italy in the first half of the nineteenth century even though listeners no doubt enjoyed hearing the curious sounds it created. Other names include BIRD WHISTLE, Merula, Nachtigall, Pájaros, Rossignol, Uccelli, and VOGELGESANG.

See also **Stop; Toy Stops**

MARCO TIELLA

NINETEENTH/LARIGOT

A foundation stop, sounding two octaves and a fifth above the struck key; the ranks are 1-1/3' (manuals) and 2-2/3' (pedal). It is usually tuned as a sixth partial (e.g., from the 4' Principal); it clashes slightly with the tempered fifth of the octave (2', 4') scales (about two cents lower than the sixth partial), causing a subtle high-pitch pungency to any combination. It serves, however, as a Diapason stop. The Larigot is by definition a wide-scaled Flute stop, sometimes called FLAGEOLET.

NOACK, FRITZ (B. 1935)

German-American organbuilder. Born in Greifswald, Noack's apprenticeship began in 1954 with Rudolf von BECKERATH in Hamburg. During his time with Beckerath he serviced historic organs in Lüneburg, Steinkirchen, and Tellingstedt; he studied a number of unrestored organs in Friesland. Noack then spent one year with the organbuilder Klaus BECKER in Kupfermühle, near Lübeck. In 1959 he emigrated to the United States, starting out at the ESTEY Organ Company. After leaving Estey, he worked for Charles B. FISK, then of the ANDOVER Organ Company, in Methuen, Massachusetts. There he worked primarily on Fisk's instrument for Mount Calvary Episcopal, Baltimore.

Noack's first organ was a three-stop positive for composer Daniel Pinkham, built at Fisk's old shop. In 1960, Noack started his own shop in Lawrence, Massachusetts. The shop moved to Andover, Massachusetts (1965), and then Georgetown, Massachusetts (1970), its present location. He has produced over 120 tracker instruments since 1960. Three organs built by Noack may be considered major turning points in his career: Worcester, Massachusetts, Trinity Lutheran (1969), a melding of the neobaroque and the American classic styles; Seattle, First Lutheran (1976), a shift toward the North German Baroque, including lead pipes, voicing with higher cut-ups, larger treble scaling, suspended key action, flexible winding, and solid wood cases; and Savannah, Georgia, Wesley Monumental United Methodist, (1985), moving in a more Romantic direction, inspired by his restoration

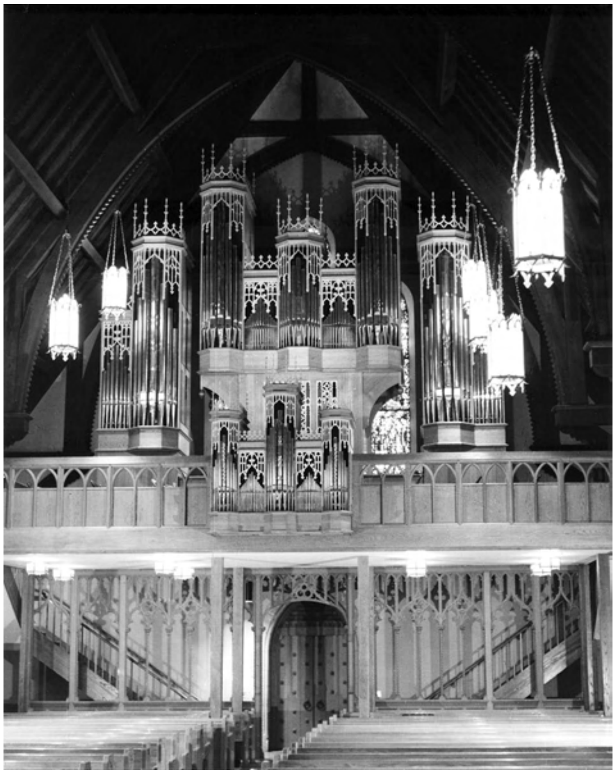

Fig. 60. Noack organ, Op. 98 (3/24), Cathedral Church of St. John, Wilmington, Delaware,

of the large 1864 HOOK AND HOOK organ at Worcester, Massachusetts, Mechanics Hall (1982).

Noack has introduced certain building techniques to the United States. In the instrument built for New York All Saints (1962), he soldered the caps onto the pipes of stopped metal ranks (a practice common among seventeenth-century builders) and transmitted (on a slider-chest) the stops of the Great to the Pedal, so that most Pedal stops were in fact from the Great. This allowed the Pedal to sound independently from the Great by way of having its own, low-pitched Mixture. He placed "double Principals" in the facade of the instrument—that is, two identical Principal pipes sharing a common foot, an early Dutch technique. To counter humidity fluctuations characteristic of atmospheric conditions in some parts of the United States, Noack applied "self-adjusting key action" consistently. Noack explored various temperaments. In 1972, he first used the early Kirnberger II in a four-stop positive. In 1973 he tuned a new organ for Decatur, Illinois, First United Methodist, in Kirnberger II without modification. Noack employed his own modification of Kirnberger II for his next instruments. Since 1982 he has used the Valotti temperament.

Noack has trained several well-known contemporary builders, including John BROMBAUGH, John Boody (of TAYLOR AND BOODY), John F. NORDLIE, and John Farmer. He has taught courses on the organ at the New England Conservatory, Boston (1970–83), and other seminars; he is also an active writer on the instrument (see Writings). He has also built a large number of practice organs for U.S. academic institutions.

MARTHA FOLTS

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NOAD, SYDNEY T(HOMAS) (1894–1971)

Australian organbuilder. Born in Sydney, Noad apprenticed with Charles RICHARDSON and established his own business after World War I, gaining the contract to maintain the five-manual William HILL and Son organ at Sydney Town Hall (1926). The economic downturn associated with the Great Depression and World War II inhibited Noad's ability to secure contracts for new organs until 1948, although his firm carried out a number of rebuilds and enlargements during this time.

Noad took his son Kenneth Sidney Noad (1930–1987) into the business as a partner in 1952. S. T. Noad and Son was the largest organ-building firm in New South Wales until it ceased to trade in 1972. Its output of over eighty new or rebuilt organs is marked by inherent conservatism and mixed success: much of the firm's work involved the production of small electro-pneumatic instruments of Romantic style, even as late as 1956, while its unit organ, of eclectic tonal disposition, was a mainstay of the 1960s. The firm's largest new organ (1961, thirty-one stops) was built for Barker College in Hornsby, New South Wales.

KELVIN HASTIE

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NOLLET

German organ-building family. The Nollet family came from Schönberg in the region of Orval. Jean Nollet (b. ca. 1680; d. ca. 1735) was the first organbuilder of the family. Some of his instruments include those built for the abbey church in Mettlach (1724); Trier, St. Martin; Koblenz, Jesuit Church (1725); Trier Cathedral (1724–27; 3/35); a positive for Prüm (1727), Cologne, Minorite Church (1729); Trier, St. Simeon (1729); and Wendalin, St. Wendel (1732).

Roman Benedikt Nollet (b. 12 Feb 1711; d. Trier, 13 Mar 1779) was a son and apprentice of Jean Nollet. After his father's death he continued the family workshop and built instruments in Bernkastel (1745); an unknown church in Trier (1746); the Catholic church in Kirchberg (1753); Trier, Paulinkirche (1756); Trier, St. Anton (1765), and Klausen, near Trier (1773).

Johann Bernhard Nollet (b. Orval, 9 Oct 1748), son of Roman Bendikt Nollet, was the last representative of the family to build organs; two of his instruments are known: the abbey church in Orval (4/75) and Prüm (1782–86; 2/25). The organ style of the Nollet family shows parallels to those of the STUMM brothers and was undoubtedly influenced by contacts with the French organ-building tradition, as seen in the names of stops and in the general design of the organ cases.

DOUGLAS E. BUSH

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NONE/TWENTY-THIRD

A foundation stop of 8/9' pitch that reinforces the ninth harmonic of the 8' harmonic series, sounding approximately three octaves and a major second above the fundamental. It is very uncommon, and appears to be unknown prior to the twentieth century. Ranks of this pitch also occasionally appear in mixtures. Also called Neuvième.

See also **Stop**

Edward L. Stauff

NORDLIE, JOHN F(RANKLIN)

American organbuilder. Nordlie (b. 1952), a former apprentice of Fritz Noack, founded the J. F. Nordlie Company after signing a contract to build a small organ for the Appleton, Minnesota, First United Methodist (1976; 1/7).

Since 1985, the firm has been located in Sioux Falls, South Dakota, and has completed twenty-five instruments to date. Nordlie's work list includes new mechanical action organs, restorations of historic American tracker instruments, and rebuilds of significant electro-pneumatic organs; the firm also supplies machinery and specialized tooling to the trade. A majority of Nordlie organs can be found in Lutheran churches in the upper Midwest.

The Nordlie Company's work is characterized by bold sound, well-regulated and sensitive actions, and a tonal character suited to strong congregational singing; thus, in the plena as well as in separate ranks, a North European influence is heard. The visual appearance is carefully proportioned and finely crafted, covering a wide range of historical prototypes and modern forms (such as American arts and crafts, Bauhaus, and Scandinavian styles).

Innovations in construction include suspended actions crafted of aluminum, with carved wooden keyheads (first use: Hubert residence, Chicago, 1986). The aluminum prevents warping and regulating problems caused by environmental extremes in American churches. Having restored several nineteenth-century organs, Nordlie has applied his insights into traditional organ design; using modern materials and methods to achieve traditional results is an identifying characteristic of his work.

Important installations include: Sioux Falls, Augustana College Chapel, (1983; 3/41, mech.); Huron, South Dakota, First Presbyterian (1986; 3/45, electro-pneum.); Aurora, Nebraska, Evangelical Covenant (rest. 1888 A. Mills organ, orig. St. Mark's Episcopal, Cheyenne, WY; 1989; 2/16, mech.); and First United Methodist, Sioux Falls (1990; 3/53, mech.).

David L. Beyer

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NORMAN AND BEARD

English organbuilders. William Norman (1830–77) was a London cabinetmaker who made cases for domestic organs. He became a voicer and worked for J. W. Walker and T. C. Lewis, but his health collapsed and he moved to Norfolk.

Ernest William Norman (1851–1927), his eldest son, set up in business as an organbuilder at Diss, Norfolk (ca. 1870). In 1876 he moved to Norwich and in 1883 established the Norwich Organ Works. His brother Herbert John Norman (1861–1936) became his partner. In 1887 they were joined by George A. Wales Beard; the firm became Norman Brothers and Beard, and Beard devoted his energies to securing sales and expanding the business. By 1896 a London office had been opened, and in 1898 the firm became Norman and Beard Ltd., with Beard as managing director. Between 1902 and 1910 a London factory dealt with export orders; the total output of the two factories averaged seventy organs a year.

Norman and Beard developed a distinctive form of exhaust pneumatic action that was extensively applied to many of the firm's organs after 1890. Wales Beard was a director of Robert Hope-Jones's Electric Organ Company, and Norman and Beard made electric actions under license from him. When the Electric Organ Company failed in 1898 it was acquired by Norman and Beard, who adopted some Hope-Jones tonal ideas on voicing and scaling string stops, the development of opaque reed tone, and the leathering of diapasons. They also experimented with console design, providing stop keys and adjustable combination pistons for organs with electro-pneumatic actions.

Among the notable organs produced by the firm were Norwich Cathedral (1899), Cheltenham College (1905), Winchester College Chapel (1908), Emmanuel College, Cambridge (1909), Usher Hall, Edinburgh (1914), and Johannesburg, South Africa, Town Hall (1916).

The outbreak of war in 1914 badly affected the business, with many of the workforce being called up for military service; the firm went into voluntary liquidation in 1916. Hill and Son acquired the stock and goodwill, and a new company called W. Hill and Son, and Norman and Beard Ltd. (Hill, Beard and Norman) was founded with Wales Beard and Arthur Hill as joint managing directors.

Nicholas J. Thistlethwaite

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NORWAY

See Scandinavia

NOTE CHANNEL

See Key Channel

O

OBERLINGER

German organ-building family. The family can be traced back to the sixteenth century, originally from southern Germany, but having settled in the Middle Rhine region. The family's first organbuilder was Johann Philipp Oberlinger (b. 2 Apr 1756; d. 1810), who worked as a carpenter for the Stumm firm in Rhaunen-Sulzbach. He was involved in building instruments in Horrweiler (1773) and Windesheim (1793), where he seems to have settled.

Jakob Oberlinger (b. 6 Mar 1842; d. 7 May 1916), great-grandson of Johann Philipp Oberlinger, apparently began organ building around 1860, but records of his activity start only in 1868, while he was working for the Weil firm in Neuwied. Jakob's first organ as an independent builder (operating out of Windesheim) was for Hargesheim/Bad Kreuznach (1869). An 1872 contract for an instrument at Winzenheim/Bad Kreuznach signaled the beginning of his collaboration with his brother, Karl Oberlinger I (b. 23 Mar 1840; d. 1919), a master carpenter. Orgelbauwerkstatt Gebr. Oberlinger, as the firm became known, took over Weil's workshop in 1888, adding the inventories of Stumm (Kirn) and Schlaad (Waldlaubersheim). After the founders' deaths, Karl Oberlinger II (1879–1962), son of Jakob Oberlinger, took over the firm. The company was hit hard by both world wars and the intervening world economic crisis; for instance, it built only two new organs between 1919 and 1927. Ironically, the melting down of tin pipes for armaments during World War I led to a business in supplying zinc facade pipes as replacements. After World War II, Karl II turned the firm over to his sons Hermann Oberlinger (1908–2002) and Ernst Oberlinger (b. 1 Jan 1915; d. Windesheim, 17 Mar 2004). The firm moved to new quarters on the outskirts of Windesheim in 1970. The present directors continue the family tradition: Helmut Oberlinger, son of Hermann Oberlinger, and Wolfgang Oberlinger, son of Ernst Oberlinger.

Oberlinger maintains a useful website, including a list of new organs (most after 1967), restorations (starting in 1966), standardized small instruments (one- and two- manual, from four to fifteen stops), and historical reproductions based solely on iconographic representations, all built in 1987 (claviorganum, Renaissance table positive, regal, Gothic positive). An organ for Rotterdam, German Evangelical Church (1881; 2/16) was relocated to Renesse, Netherlands, Jacobuskerk in 1939. Oberlinger's larger instruments include: Kaiserlautern, Germany, Protestant Stiftskirche, 1968 (4/64); Amherst, University of Massachusetts, 1976 (3/45); Bonn-Beuel, Germany, St. Joseph, 1981 (3/58); Jerusalem, Dormitio Abbey on Mount Sion, 1982 (3/37); Nassau, Bahamas, Christ Church Cathedral, 1986 (3/43); Taejon, Korea, Taejon Church, 1994 (3/37); Kusel, Germany, Protestant Church, 1997 (3/33; in 1845 Stumm case); Vallendar, Germany, SS Marcellinus and Peter, 1998 (3/52); Beijing, China National Radio, 1999 (3/50); and Riga, Latvia, St. Peter's, due 2006–7 (4/77). Unsurprisingly, Oberlinger's instruments for Germany are found largely in the Middle Rhine region, where its workshop is located. Other areas of concentration include the United States (Northeast), Switzerland (northern), and Luxembourg (southern). Among its restored organs are: Kirchheimbolanden, Germany, St. Paul's (1745

Stumm and Sons organ, 1966; 3/45; mech., slider-chests); Bechtolsheim, Germany, Simultankirche (1756 Stumm organ, 1977; 2/26; mech., slider-chests); Lublin, Poland, Evangelical Luthern (1912 WALCKER organ, 1988; 2/11; pneum. cone-chests); Loja, Ecuador, Roman Catholic Cathedral (1892 W. Sauer organ, 1994; 2/20; mech. cone-chests); Paysandú, Uruguay, Roman Catholic Basilica (1906 Walcker organ, 1997; 2/23; pneum. cone-chests/pneum. membrane-chest); and Luxembourg, Evangelical Trinity (1877 Stumm Brothers, 1998; 2/18; mech. cone-chests).

Oberlinger has received recognition for inventions such as the *Externe Balancier*, which keeps larger tracker mechanisms fluid without losing precision and sensitivity. A variant of the flue Subbass, the Cubus 16', takes one-seventh of the cubic space and can thus be installed in smaller organs. Finally, the *Windberuhigung* ("wind calmer"), a large beaker-shaped device, is placed near the output of electric blowers to offset air vortexes that arise from relentless winding. This last item is among the many objects (mostly historical instruments) on display at the Orgel ART Museum in Windesheim, Germany, under the auspices of the Oberlinger family.

RICHARD KASSEL

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OBERWERK

Since the sixteenth century, a division located above the HAUPTWERK, with its facade (Prestant) pipes located on the same vertical plane as those of the Hauptwerk. The OBERWERK (Dutch *Bovenwerk*) was at times synonymous with the Hauptwerk, and *Oberpositiv* applied to the division above it (Tangermünde, St. Stephan, Scherer the younger, 1623–24; 3/32; rest. Schuke, 1991–94). But the more common meaning was already in use by northern European builders as early as 1505, when Jan van COVELENS described an Oberwerk located above the BLOCKWERK (the original Hauptwerk), in addition to a RÜCKPOSITIV (Zwolle, St. Michael, 1505). In the sixteenth century, most organs had a BRUSTWERK immediately above the console and below the Hauptwerk, but no Oberwerk. However, an organ at Hamburg, St. Jacobi (Hans Scherer der Älter, 1606) had an Oberwerk as well as a Brustwerk (4/53). Arp SCHNITGER retained Scherer's layout in his 1692 renovation (4/61); his major change was adding stops to the Brustwerk. At Norden, St. Ludgeri (1686–88), Schnitger built a new instrument with pipes from earlier instruments. The three-manual instrument originally had three divisions (3/38), but Schnitger added an Oberwerk (or Oberpositiv) in 1691–92, to be played from the third manual (3/46). Schnitger's larger instruments (Hamburg, St. Nicolai) used this structure. Eugenio CASPARINI built an organ with Oberwerk and Brustwerk, but no Rückpositiv (Görlitz, St. Peter and Paul, 1703; 3/56). This became the model for Gottfried SILBERMANN (Freiburg, Cathedral, 1714; 3/44); both Oberwerk and Hauptwerk have thirteen stops, and the visual separation (from bottom: console, Brustwerk, Hauptwerk, Oberwerk) is classical in design. Silbermann began using the term *Oberwerk* regularly in his two-manual instruments as well.

The northern European Oberwerk was essential to the Baroque music written for it. An alternative to the Hauptwerk, it had almost equal weight and enough distinctiveness in sonority to balance the contrapuntal needs of Johann Sebastian Bach and other composers. The Rückpositiv and Brustwerk were reserved for accompanimental roles and, if needed, dynamic effects. But the Oberwerk lost its individuality during the eighteenth century. The term changed meaning in the nineteenth century, when the English SWELL began to make its way into German organ building. It became synonymous with *Schwellwerk* or *Schwellklavier*. French builders, who were already building divisions with expression (RÉCIT, SOLO, ECHO), had no need for additional terminology.

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OBOE/HAUTBOIS/HAUTBOY

(1) A nonimitative reed stop of 8' or (less often) 4' pitch (manuals), 16' or 8' (pedal). By the seventeenth century, the Oboe had become a Récit Trompette hybrid with narrow, inverted conical resonators and a bell at the top, open or capped. It is used as a solo and ensemble stop, adding a distinctive brightness to flue choruses.

(2) The modern Orchestral Oboe, an imitative 8' reed stop, inverted conical to the top, with a characteristic thin, nasal, and direct (if not overly loud) tone. It loses its brilliance when surrounded by other ranks, for which builders compensate by using spotted metal; the pipe is usually wholly or partly stopped.

OCTAVE

(1) A foundation or Principal stop one octave higher than the Open Diapason (Principal) rank of a given organ; thus, the 4' Octave of an 8' Open Diapason–based organ, 8' Octave of a 16' organ, and so on. It is the rank to which all others are tuned. From the mid-nineteenth century on, *Octave* became a synonym for *Major Octave*, a more powerful version.

(2) As a suffix, any stop sounding an octave higher than its standard register (Echo Octave, Gemshorn Octave, Oboe Octave, Viola Octave, etc.).
See also **Stop**

OCTAVE COUPLER

See Mechanical Aids

OCTAVIN

A stop reportedly introduced in France in the middle of the nineteenth century by Aristide Cavaillé-Coll, who constructed it as a 2' Flûte Harmonique and used it extensively, sometimes under the name Octavin Harmonique. Later usage of the name varies, particularly in the twentieth century, when the meanings of many stop names were diluted or altered. Thus some sources claim it to be equivalent to the Superoctave, though the proper French name for that stop is Doublette.
See also **Stop**

Edward L. Stauff

ODELL

American organ-building family. The brothers John Henry Odell (1830–1899) and Caleb Sherwood Odell (1827–1892) started J. H. and C. S. Odell in 1859. The longest, lived of the New York City organ-building firms founded in the nineteenth century, it initially ceased operation around 1983, by which time the company had produced slightly over six hundred organs. The quality of its engineering and workmanship was high, and Odell enjoyed a reputation comparable to that of its far larger competitors.

The Odell brothers apprenticed with Richard M. Ferris. Shortly after Ferris's death in 1858, the Odells began work on their own. Although the company was not formally incorporated until 25 November 1860, records date the first contract to 1859. The Odells subcontracted their early instruments to William and Thomas Robjohn and to Levi U. Stuart, half-brother and successor of Ferris. In 1868, they moved into their own factory and commenced to complete their own contracts.

The Odells were best known for their mechanical innovations. In 1866, they patented the first pneumatic combination thumb piston, and in 1872 the first tubular-pneumatic key action (newly patented 1898). They were also among the first American builders to incorporate the register crescendo. Other innovations were less salutary, among them an apparatus for imitating a thunderstorm.

Notwithstanding their interest in things mechanical and novel, the Odells usually included full chorus ensembles with mixtures and solo registers on their divisions. The Odell plenum had a fullness, but a pronounced lack of brilliance, because of reduced scaling in higher-pitched stops and in the upper registers of unison ranks. Odell's keydesk design was conservative; the firm used flat projecting stopjambs long after other builders had gone to a terraced layout. Odell's cases were functional and usually eschewed extra carving and ornament.

Among the Odells' larger contracts were organs for St. Paul's Episcopal (1870), St. Bartholomew's Episcopal (1873) and Fifth Avenue Presbyterian (1893), all in New York; Troy, New York, Music Hall (1872, reb. 1890; 3/41; extant); Brooklyn, New York, St. Charles Borromeo (1880; 3/35; extant); Hyde Park, New York, Dutch Reformed (1888; 2/12; extant); South Norwalk, Connecticut, United Methodist (1898; 2/21; extant); New York City, St. Nicholas (1899; 4/50); Palm Beach, Florida, Flagler Mansion (1901; 2/21; extant); New York City, Temple Emanu-El (1901; 4/65, firm's largest; lost); and Albany, New York, St. Joseph's (1912; 4/59; extant).

After the passing of the founders, the firm was led in succession by William Henry Odell, son of Caleb Sherwood Odell; George Washington Odell (b. New York, 30 May 1857), son of John Henry Odell, who became president in 1899; Caleb Herbert Odell (b. New York, 27 May 1879; d. Yonkers, New York, 3 October 1944), son of William Henry Odell, who joined the firm in 1899 and became a partner in 1911 (invented Odell electromagnetic system, 1914); and William Herbert Odell (1909–1979), son of Caleb Herbert Odell, who succeeded his father and led the firm until his death. In the post–Organ Reform Movement era, the older type of Odell organ could not compete, and the firm closed in 1993. However, Edward Odell, nephew of William Herbert Odell, was employed by the Austin Organ Company (1995–2002) before reestablishing the Odell firm in East Hampton, Connecticut, with his wife and partner, Holly Hawn Odell (2003). The reincarnated firm rebuilt a 1948 Wicks organ for Glastonbury, Connecticut, Lutheran Church of St. Mark (2004; orig. Bernville, PA, United Church of Christ).

John K. Ogasapian

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OECKELEN, VAN

Dutch organ-building family. Cornelis Jacobus van Oeckelen I (b. 1762; d. 29 Aug 1837), a Brabantine Roman Catholic, made clocks, carillons, and mechanical instruments in Breda; self-taught, he began to work on organs in 1805. In 1810, Cornelis Jacobus I moved to Groningen (a Protestant city) and repaired organs (s'-Gravenmoer, Dutch Reformed; Breda, Notre Dame Cathedral; Goes, Cathedral). All van Oeckelen instruments originally had pull-down pedals (unless otherwise indicated herein). He built his first instrument for Prinsenbeek, Roman Catholic, 1822, followed by Waalwijk, St. John the Baptist (Reformed), 1822 (2/19; rest. Flentrop, 1986; now 2/23). The company Cornelis van Oeckelen and Zonen built organs at Oud-Beijerland, Dorpskerk (Reformed), 1826–27 (2/16) and Hooge Zwaluwe, Reformed (1828; 1/7; destr. 1910).

Cornelis Jacobus I was commissioned to build an organ for Strijen, Dutch Reformed (1837); it was completed by one of his sons, Petrus van Oeckelen (b. Breda, 15 Aug 1792; d. Harenermolen, 13 Aug 1878). Petrus had studied organ building with Heinrich Hermann FREYTAG and J. W. Timpe. His first organ was for Assen, Reformed, 1819 (2/17; to Havelte, Dutch Reformed, 1897; rest. Mense Ruiter, 1984–92). He helped design Timpe's organ at Groningen, Nieuwe Kerk (1829). In 1837, Petrus took over the workshops of his father and Timpe, both of whom died that year, and moved to the Groningen suburb of Harenermolen. Jan Jacobus van Oeckelen (d. 1860), son of Cornelis Jacobus I, worked in the family business; another son, Cornelis Jacobus van Oeckelen II (b. 1798; d. New York, 1865), was an inventor and clarinetist. He was briefly associated with the firm, but emigrated to Indonesia in 1840 (reb. organ at Semarang, Java, Reformed, 1844–47); he moved to the United States in 1855.

Petrus, the most important organbuilder in the family, built instruments on a par with the smaller instruments of BÄTZ, van DAM, van Dinter, and SMITS. He brought several innovations to northern Dutch organs: the RESERVOIR, from Germany; employing metal parts in stop actions; and industrial methods, notably standardized cases and parts. Petrus used classical pipe-making techniques, and built only tracker instruments; but he introduced Romantic elements into his stoplists and elsewhere.

A number of Petrus's instruments and important rebuildings have withstood subsequent "modernizations," world wars, and recent restorations (often based on Oeckelen's original plans). Among the survivors are: Zwolle, Cathedral (reb. 1721 F. C. Schnitger organ; 1837; 4/64; rest. Flentrop, 1985–89); Strijen, St. Lambert (1839; 2/21; reb. van den Heuvel, 1973–75; now 2/33); Hoogeveen, Cathedral (reb. 1843 Scheuer organ; 1861; 1/25; rest. Pels/van Leeuwen, 1969; now 2/25); Groningen, Martinikerk (Roman Catholic) (reb. 1627 Verbeeck/1692 A. Schnitger/1730 F. C. Schnitger and Hinsz organ; 1854–55; rest. Ahrend, 1976–77; now 3/54); Noordbroek, Reformed (altered 1696 Schnitger/1768 Hinsz /1809 Freytag organ; 1855; rest. Graafhuis and Edskes, 1958); Groningen, Aa-Kerk (reb. 1702 A. Schnitger/1830 Timpe; 1857; controversy over restoration—to Schnitger or van Oeckelen state—resolved 1999); Steenwijk, Cathedral (1861; 2/26); Middelstum, Reformed (reb. 1776 Hinsz organ; 1863; 2/21; first free-reed Clarinet in northern Netherlands); Harlingen, Reformed (reb. 1776 Hinsz organ; 1864; 2/34; rest. Flentrop, 2001); Amsterdam, Oosterkerk (1871; 2/24); Arnhem, Kruisekerk (1873; 2/13; rest. 1993); and Stadskanaal, Reformed (Oosterkade) (1876; 2/15; rest. Leeflang, 1981).

Cornelis Aldegundis van Oeckelen (1829–1905), Antonius van Oeckelen (1839–1918), and, to a lesser extent, Henderikus van Oeckelen (1835–1894), all sons of Petrus, began working with their father as early as 1860. They continued the firm, now in Glimmen (another Groningen suburb) under the name P. van Oeckelen en Zonen. The remarkable productivity during Petrus's tenure waned under his sons' leadership. Henderikus, never much favored by Petrus, went out on his own, working as a carpenter and tuner. Among the third generation's instruments are: Steenwijk, Klein of Onze-Lieve-Vrouwekerk (1880); Assen, Kandelaarkerk (1884; 2/10; reb. Mense Ruiter, 1981); Olst, St. Willebrorduskerk (Reformed) (1888; 2/17; rest. Reil, 1974; now 2/19); Kloosterburen, Reformed (1898); and Leek, Reformed Church (1915; last new organ built by the firm). The firm dissolved in 1918.

Although Petrus van Oeckelen's work has received the familiar negative assessment by purists in the Baroque organ conservation movement, his rebuilding was comparatively respectful of the past, and more often a matter of repairing defective bellows and actions. The continuing presence and popularity of his instruments has contributed to the neoromantic conservation movement, embodied in the recent restoration work of Mense Ruiter Orgelmakers, Zuidwolde); more immediately, his work has been honored with a compact disk set, "The Organ Builder Petrus van Oeckelen," featuring eighteen organs.

See also **Reil**

RICHARD KASSEL

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OFFSET CHEST

See Windchest

ONDERPOSITIEF

See Unterwerk

OPEN WOOD

A flue pipe of large scale and rectangular wooden construction, found on mid-nineteenth- to mid-twentieth-century English organs, almost exclusively on the pedals. Until the nineteenth century, most English organs had no independent pedal departments, instead taking their manuals down to modern GG (the long compass) and providing pull-down pedals. Where pedals had any stops of their own, they were large-scale and in unison pitch to emphasize the bass. (These went down to 12’ CC, modern G.) When the German model was adopted in the nineteenth century, with its C compass manuals and larger Pedal division, this bass stop was extended to 16’, continuing to provide a strong underpinning of the ensemble. At the turn of the twentieth century, the Open Wood was joined by a Bourdon, often with octave extensions. They took up a huge amount of space; since the dawn of the Organ Reform Movement, independent Pedal departments have often displaced these stops. In the English cathedral organ, the 32’ Open Wood supports the Principal chorus. Wind pressure can be remarkably small, less than 2”. Although sometimes described as an Open (wood) Diapason, its vast scale makes the stop much more like an open Flute in tone.

Alastair Disley

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OPHLICLEIDE

An especially strong chorus reed with thick walled, full-length conical resonators of 8’, 16’, or 32’ pitch, intended to imitate the bass key bugle of the nineteenth century (eventually replaced by the euphonium in wind and brass ensembles). The stop was popularized by William Hill, primarily as a pedal rank.

ORAGE

(Fr. “storm.”) A device common in French nineteenth-century organs by which the player could imitate thunder in improvisations of storm pieces. The mechanism consisted of a wooden pivoting lever traversing nine or more of the lowest pedalboard keys in either the console or keydesk. As practiced by Aristide Cavaillé-Coll, the lever commanding the pedal action was activated by an iron pedal, invariably located at the extreme left of the series of *pédales de combinaison*. Unlike the remaining pédales, however, the Orage (*effect d’orage*) could not be latched in the “on” position, but had to be depressed by foot for the desired duration. Since the Orage operated via a traditional tracker action, any combination of pedal stops, even coupled to manual stops, could be utilized. The course of the pedal itself consisted of several inches, allowing organists to open corresponding pallets slowly or rapidly and to stop the pedal at any point, thereby producing a remote rumble or an all-out apocalypse. Franck employed the Orage in the early version of his C Major Fantasy and provides precise notation of the dynamics and length of each use of the Orage effect.

See also **Donner/Sturm/Storm or Thunder Pedal; Drum Pedal; Pauke/Trommel**

Jesse E. Eschbach

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ORCHESTRION

A name for two instruments, one an organ for human performers, the other an automaton. The playable orchestrion was a large (about 9.2’ square) transportable organ with which Georg Joseph Vogler toured Europe (1789–90). It had four manuals, a pedal, and sixty-three stops. This instrument was in part designed according to Vogler's simplification system, which reduced the number of pipes by using difference and addition (sum) tones. Many stops were based on the recently invented FREE REED, which allowed for variable wind pressure. Finally, the entire organ was enclosed in a SWELL box, provided what for the time was a greater range of expression (dynamic flexibility).

The MECHANICAL ORGAN known as the orchestrion was developed toward the end of the eighteenth century. It was intended to replace automatic organs of the period, with their unchanging tone color and dynamics. A large, complex barrel organ of the flute-clock type, the orchestrion's goal was the imitation of an entire orchestra. The pipes were opened by levers, activated by means of perforated cards, pinned cylinders, or similar devices. In 1789 Johann Strasser made such an instrument in St. Petersburg. Other builders followed, notably the Mälzel brothers, who continued the work of the eighteenth-century French makers Jacques de Vaucanson (1709–1782; "Flute Player," 1737) and Pierre Jacquet-Droz (1721–1790). Johann Nepomuk Mälzel (1772–1838), best known for patenting the metronome (actually invented by Dietrich Nikolaus Winkel), invented the panharmonicon (1804), in which imitative string stops were added. In 1813 he made a second version of the panharmonicon and was able to convince Ludwig van Beethoven to write a battle symphony (*Wellington's Victory*) for it. (It has never been "performed" on any orchestrion, only by an orchestra.) His brother Leonhard Mälzel constructed the so-called Orpheushamonicon in 1814. In 1821, Winkel built the self-composing COMPONIUM in Amsterdam.

In the meantime, several central European builders (Joseph Blessing, J. H. Heller, Mermod Frères) were pursuing the building of various musical automata. Among the better known makers, the Kaufmann family worked mainly in Dresden. The firm invented the belloneon in 1805; it had twenty-four reeds and pipes in the shape of a trumpet (inspired by the firm's own automatic trumpet player) as well as two cymbals. Other Kaufmann instruments included the harmonichord (a sort of bowed piano), the chordaulodion (with variable air pressure), and the symphonium (combining a piano, clarinets, flutes, clappers, and a drum).

In London, Flight-Robson built the Apollonicon in 1812. This was an organ that could be played by five men (one for each manual, four of which were placed around a central manual) or could operate completely automatically. Decisive steps in the development of the orchestrion were the invention of the cartonium by J. A. Teste of Nantes in 1861; it used a perforated disc instead of the much heavier cylinders, both systems allowed relatively short durations on disc or cylinder. This problem was solved by (1) perforated paper rolls (with tracker bars keeping the rolls in place), or (2) the so-called book system in which continuous perforated cardboard was folded like pages.

Ludovic Gavioli from Modena started his factory in Paris (ca. 1845), where Anselme Gavioli (d. 1902) invented his version of the "book organ" in 1892. (The firm was purchased by Limonaire Frères in 1910.) Electric power increased the possibilities, as did Welte's application of pneumatic action to automata (1886).

During the nineteenth century, the European orchestrion took other forms, especially the fairground or band organ. Although the orchestrion had been invented to play classical music, it soon became associated with popular music. The real explosion of its popularity took place in Belgium, where it was used mainly as a big dance organ. Belgian manufacturers included Charles Marenghi (Brussels; trained by Gavioli), Louis Hooghuys (Geraardsbergen, later Brussels), and De Cap and Burssens (Hoboken, near Antwerp). The most famous and also richly decorative orchestrions came from the factory of Theophile MORTIER, who had learned to build them by copying the Gavioli instruments he purchased for his café. His instruments could be as large as 40' wide and 35' high. Belgian orchestrions were considered superior to French and German organs, due to the division of the stops into melody and harmony types; the so-called accompanimental stops and the percussion also played an important part. Hooghuys was the only Belgian maker specializing in fair organs.

In the Netherlands, the instrument took the form of a large street organ, known in Amsterdam as the *pierement* (from the Dutch *pieren*, to dance). It was introduced in 1875 by the Belgian Léon Warnies, who rented the organs out to the grinders. The later development of the orchestrion there was spearheaded by the German Carl Frei, who had learned the trade with Mortier but later settled (1920) in Breda. After World War II, the orchestrion disappeared from the scene, except for the revival of the pierement in the Netherlands.

In America, the history of the orchestrion begins in 1856 with A. S. Denny's calliope, an organ in which steam provided the necessary air pressure for the pipes. The calliope could be played manually or automatically. Orchestrions never became popular in the United States; they found a place as "photo-player" cinema organs (again capable of playing rolls automatically or of being played manually).

FERDINAND J. DE HEN

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ORGAN CLEARING HOUSE

The Organ Clearing House (OCH), an American organization, was founded to preserve distinguished vintage pipe organs by relocating them when their original homes are lost. This was in response to the large number of instruments being destroyed as church buildings were being torn down in the interest of urban renewal and the construction of the U.S. interstate highway system. This preservation activity was first promoted as a column in the newsletter of the fledgling Organ Historical Society (OHS), founded in 1956. In 1961, Alan Laufman, an early and enthusiastic participant in the preservation movement, petitioned the OHS to allow him to take over the activity as an independent company. At the outset the operation of the new company was a part-time endeavor as Laufman continued his career as a prep-school English teacher, often enlisting his students to help dismantle organs on weekends. The OCH was based in Harrisville, New Hampshire, with storage facilities in Enfield, New Hampshire.

One notable organ relocation project accomplished by the OCH was the installation of a three-manual organ (opus 576) built by Hook and Hastings in 1871. Removed from New York City, St. Alphonsus (closed 1980), the Hook organ was installed in New Haven, Connecticut, St. Mary's. The OCH has accomplished several international pipe organ relocations. For example, the large three-manual Hook organ built in 1870 for the First Unitarian Church of Woburn, Massachusetts (opus 553), was restored by the German firm Eule and installed in Berlin's Church of the Holy Cross in 2001.

In 1994 the company was reorganized as a limited liability corporation with Amory Atkin and Joshua Wood joining Laufman as partners. Prior to his death in November 2000, Laufman appointed John Bishop to succeed him as executive director, joining Atkin and Wood. Shortly before his death, Laufman estimated that the OCH had been involved in the relocation of more than two thousand pipe organs. The new leadership established offices in Lexington, Massachusetts, while maintaining the storage facility in New Hampshire.

See also **Organizations**

John Bishop

Bibliography

Organ Clearing House On-Line. <http://www.organclearinghouse.com/>.

ORGANETTE

See Mechanical Organ

ORGAN HISTORICAL SOCIETY

See Organizations

ORGAN HISTORICAL TRUST OF AUSTRALIA

The Organ Historical Trust of Australia (OHTA) was founded in 1977, shortly after the establishment of its sister organization, the British Institute of Organ Studies, and was incorporated in 1978 under the Victorian Companies Act. It is a national organization with members in all six Australian states and overseas, and has a national council. The founding of the organization was precipitated by the wholesale introduction in the 1950s and 1960s of electric actions and tonal modifications, often in an alien style, resulting in the irretrievable alteration of numerous historic instruments, with a loss of mechanical and tonal integrity.

Soon after its establishment, the OHTA successfully lobbied the New South Wales government for assistance in three areas: funding for the documentation of significant instruments; heritage protection for significant instruments; and financial assistance for approved organ restoration projects. It has also liaised actively with government and private heritage bodies such as the National Trust of Australia. The OHTA has acted as a monitoring body for the preservation of significant instruments and has been successful in ensuring the sympathetic preservation of the majority of instruments, sometimes in the face of controversy. The OHTA also sponsored a far-reaching project to document significant instruments in Australia and New Zealand. This work was carried out by John Stiller (1945–2002) and saw more than three hundred instruments surveyed and their historical and technical details carefully recorded.

One of the OHTA's major achievements over the past quarter-century has been the large number of instruments that have received a careful restoration, respecting the original builder's mechanical and tonal concepts. These have often involved the reconstruction of missing components to a high standard of authenticity. The documentation of this heritage also has been impressive, both in printed and electronic form.

Other activities carried out by the OHTA have included annual conferences, held throughout Australia and New Zealand and promoting an enhanced awareness of instruments in a particular region. Its publications have included the first edition of the "Australian Pipe Organ Preservation Standards" and the quarterly journal *OHTA News*. A website was established in 1998; it includes gazetteers of pipe organs in various Australian states and a listing of Australian organ compositions.

See also **Organizations**

JOHN MAIDMENT

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Organ Historical Trust of Australia. <http://www.vicnet.net.au/~ohta/>.

ORGANIZATIONS

Because of the distinct types and the unique personalities and histories of individual instruments throughout the world, interest groups have an extremely wide scope where it comes to the organ. There are virtually no international groups dedicated to the organ in all of its manifestations; organ groups are divided into those for pipe instruments (subdivided into church and theater organs), reed organs, and mechanical instruments. Major figures in organ history (builders, composers, performers) are sometimes honored by academic organizations. National groups are plentiful, whether functioning as centralized not-for-profit corporations with officers, annual conventions (often pedagogically oriented), or geographical divisions, or as umbrellas for smaller groups. Finally, there are organizations dedicated to single instruments, usually formed to raise money to restore and maintain an instrument representative of musical quality or community pride. The development of the Internet has not only expanded the reach of many organizations, but also led the way to groups that exist solely online and whose content may be in the hands of a single individual.

The lists below are a sample of organizations nationally and internationally, with an emphasis on larger groups, and give the groups' names, acronyms (if applicable), dates of founding, and present locations of headquarters and/or an Internet address. A list of groups dedicated solely to one instrument, composer, or performer would number in the many hundreds alone.

United States

American Guild of Organists (AGO), 1896, New York
American Handel Society/Handel-L, 1986, College Park, Maryland
American Institute of Organbuilders (AIO), 1974, Houston
American Organ Archive (OHS), 1961, Princeton, New Jersey
American Theatre Organ Society (ATOS), 1955, Indianapolis
Associated Pipe Organ Builders of America (APOBA), Chicago Ridge, Illinois
Association of Young Organists (formerly Organ Geeks), 1967, Worcester, Massachusetts
Atlantic City Convention Hall Organ Society, 1997, Annapolis, Maryland
Biggs, E. Power Fan Site < http://web.wt.net/~pallas/BiggsSite.htm>
Boston Organ Club (of AGO), ca. 1965, Boston
Chicago Area Theatre Organ Enthusiasts (of ATOS), Wheaton, Illinois
Connecticut Music Teachers' Association, 1890 (merged with AGO)
Dickinson Theatre Organ Society, 1969, Wilmington, Delaware
Fox Society, Virgil, 1978, Ridgewood, New York
Foxtail, *see* Mechanical Music Digest
Free State Theatre Organ Society (of ATOS), 1984, Catonsville, Maryland
Friends of the Wanamaker Organ, 1991, Philadelphia
Garden State Theatre Organ Society (ATOS), 1973, Skillman, New Jersey
Institute for Pipe Organ Research and Education, 2002, Charlotte, Virginia
Joliet Area Theatre Organ Enthusiasts (of ATOS), Joliet, Illinois
Los Angeles Theatre Organ Society, 1961, Los Angeles
Mechanical Music Digest (Foxtail), 1995, San Diego
Midwestern Historical Keyboard Society, Grand Rapids, Michigan
National Associations of Organists, (merged with AGO)
Organ Clearing House, 1959, Lexington, Massachusetts
Organ Historical Society (OHS), 1956, Richmond, Virginia
Organ Literature Foundation of the USA, 1970, Braintree, Massachusetts
Organtek, Knoxville, Tennessee
Pacific Council of Organ Clubs, Inc., ca. 1975, Sunnyvale, California
Piedmont Theatre Organ Society, Liberty, North Carolina
Pipe Organ Foundation, Mercer Island, Washington
PIPORG-L (online), 1993, Albany, New York
Reed Organ Society, 1981, Wichita Falls, Texas

Reger Pages, Max, 1997, New York
Rochester Theater Organ Society, 1964, Rochester, New York
Southeastern Historical Keyboard Society, 1980, Charlotte, North Carolina
Westfield Center (formerly Westfield Center for Early Keyboard Studies), 1979, Seattle

Outside the United States

Academia Mexicana de Música Antigua para Órgano, 1990
Accademia Organistica Campana, Naples
Alain Association, Jehan, 1987, La Maison du Prieur, Switzerland
Amis de l'Orgue, Luxembourg City
Amis de l'Orgue de Montréal, 1990, Montreal
Arbeitsgemeinschaft für Schweizerische Orgeldenkmalpflege, 1958, Fribourg, Switzerland
Arte Organaria Italiana, A&C 2000 (database), 1996
Associação Brasileira de Organistas, 1992, Mariana, Brazil
Associação Portuguesa Amigos do Orgao, Ansiao, Portugal
Associació Catalona de l'Orgue, Barcelona
Association Connaisance de l'Orgue, Le Havre, France
Association Francaise pour la Sauvegarde de l'Orgue Ancien, 1967, Paris
Association François-Henri Clicquot à Poitiers, 1949, Vouneuil-sur-Vienne, France
Association National de Formation des Organistes Liturgiques, 1969, Lyon, France
Association of Independent Organ Advisers, Ipswich, England
Association Orgues Méridionales, Toulouse, France
Associazione Accademia Romana d'Organo, Rome
Associazione Italiana Organisti di Chiesa, 1995, Reggio nell'Emilia, Italy
Associazione Musicale Organum, Viterbo, Italy
Associazione Siciliana Amici dell'Organ, Palermo
Associazone Culturale Storici Organi del Piemonte, Biella, Italy
Bach-Archiv, 1950, Leipzig, Germany
Brahms WebSource, Johannes, 2002, Vancouver, British Columbia
British Institute of Organ Studies (BIOS), 1975, Haslingfield, England
British Organ Archive, 1974, Birmingham, England
Bund Deutscher Orgelbaumeister (BDO), 1895, Munich
Cavaillé-Coll Association, Aristide, ca, 1977, Paris
CEOS, Nieuwkerken-Waas, Belgium
Cinema Organ Society, 1952, Southhampton, England
David Gesellschaft, Johann Nepomuk, 1975, Stuttgart
Duruflé Association, Maurice et Marie-Madeleine, 2000, Paris
Dutch Organ Archive (database), 1998, Utrecht
English Organ Archive, *see* British Institute of Organ Studies
Estonian Organ Society, 1994, Tallinn, Estonia
European Guild of Organists, 1997, Paris
European Organ Index (EOI; database), European Union, Brussels
Fair Organ Preservation Society, 1957, Milton Keynes, England
Fédération Francophone des Amis de l'Orgue (FFAO), 1993, Lyon, France
Fédération Québécoise des Amis de l'Orgue, 1964, Quebec City
Fondazione Accademia di Musica Italiana per Organo, Pistoia, Italy
Förderverein Orgelforschung, 1994, Stuttgart
Fortbildung für Haupt- und Nebenamtliche Organisten im Kultur-Institut Rossignol, Nister-Mährendorf, Germany
Gesellschaft der Orgelfreunde (GdO), 1951, Mettlach, Germany
Göteborg Organ Art Center (GOArt; database), 1995, Göteborg, Sweden
Groupement Professionnelles Facteurs d'Orgues Francais, 2000, Paris
Huddersfield Organists' Association (IAO), 1903, Huddersfield, England
Incorporated Association of Organists (IAO), 1916, Birmingham, England
Incorporated Society of Organ Builders, 1947, West Yorkshire, England
Institute of British Organbuilding, Bury St. Edmunds, England
International Organ Foundation, 1990, Madrid
International Society of Organ Builders, 1957, Lidingö, Sweden
Internationale Arbeitsgemeinschaft für Orgeldokumentation, 1990, Berlin
Japan Organ Society, ca. 1973
Koninklijke Nederlandse Organistenvereniging (KNOV; formerly Nederlandse Organisten Vereniging), 1890, The Hague
Kring van Draatorgelvrienden, 1954, Gorenchem, Netherlands
Ladegast-Kollegium, 1997, Weissenfels, Germany
Lancastrian Theatre Organ Trust, Manchester, England
Langlais Site, Jean
London Society of Organists
Mechanical Organ Owners' Society, 1976, Norwich, England
National Pipe Organ Register at Cambridge (of BIOS), 1991, Cambridge

Ned Orgel Federatie NL (cinema organs), 1970, Amsterdam
Nederland Orgelland (online), Breda, Netherlands
New Zealand Association of Organists, Christchurch
Nippon Orugan Kenkyūkai (Japan Organ Society)
Organ Alternatives (online), 1992, Georgetown, Ontario
Organ Club (founded by Henry Willis III), 1926, London
Organ Historical Trust of Australia (OHTA), 1977, Camberwell, Victoria
Organ Music Society of Sydney, Australia, 1950
Organ Society of Queensland, Australia, 1952, Fairfield Gardens
Organ Society of Western Australia, 1966, Perth
Organeum in Weener, Germany
Organum-Seuran, 1964, Helsinki
Orgel in Vlaanderen, 1990, Antwerp
Orgeldatenbank Berlin (ORDA), 1985
Orgellandschaft Brandenburg, Germany
Orgler i Danmark, Copenhagen
Orgue et Compagnie, 1995
Orgues d'Alsace, Strasbourg, France
Osiris Archive of Organ Specifications, 1994, Ladner, British Columbia
Pipe Organ Preservation Co. of Ireland, Belfast
Pipe Organ Tracker Project, ca. 1997, Hamilton, Ontario
Promotieteam Orgel en Keyboard, 1996
Redundant Organ Rehousing Company (formerly part of BIOS), 1997, Kington, England
Research Centre for Organ Documentation, *see* Orgeldatenbank Berlin
Route des Orgues de France, 1980, Paris
Royal Canadian College of Organists, 1909, Toronto
Royal College of Organists, 1864, London
Royal Dutch Association of Organists, 1890, The Hague
Royal School of Church Music, 1927, Dorking, England
Royal Society of British Organists, Huntingdon, England
Schnitger, Arp Gesellschaft, 2000, Bracke, Germany
Scottish Theatre Organ Preservation Society, 1972, Greenlaw
Silbermann, Gottfried Gesellschaft, Frauenstein, Germany
Society of Organists, Victoria, 1938, Camberwell, Australia
St. Galler Orgelfreunde, 1982, Rickenbach, Switzerland
Stichting Groningen Orgelland, 1969, Uithuizermeeden, Netherlands
Stichting Orgelhistorische Studies, Vlaardingen, Netherlands
Stichting tot Behoud van het Nederlandse Orgel, 1973, Elburg
Svenska Orgelsällskapet, 1978, Göteborg, Sweden
Theatre Organ Society of Australia, ca. 1960
Ulster Society of Organists and Choirmasters (IAO), 1918, Belfast
Vereinigung der Orgelsachverständigen Deutschlands, 1971, Karlsruhe
Vlaamse Vereniging ter Bevordering van de Orgelkunst, ca. 1978, Grimbergen, Belgium
Walcha, Helmut, 2000, Korea
Wellington Organists' Association, New Zealand

RICHARD KASSEL

ORGAN LIBRARY

A research library officially opened in 1985, jointly maintained and administered by Boston University and the Boston chapter of the AMERICAN GUILD OF ORGANISTS (AGO). It is located in the E. Power Biggs Room, adjacent to the Theology School Library at Boston University. The library's holdings are restricted to materials pertaining to the organ, organ music, church music, organists and organbuilders, and the AGO. These materials include books and dissertations, scores (including manuscripts), periodicals, papers, concert programs, photographs, and sound recordings.

The Organ Library was originally established to house important collections donated to the Boston AGO chapter by the estates of E. Power BIGGS, William King Covell, and Edward Flint. Subsequent donations of material from the estates of Arthur Howes, Lillian Murtagh, T. Tertius Noble, Samuel Walter, and Homer Whitford, along with many donations of smaller proportions, have expanded the collection considerably. The library is used by scholars and researchers from all over the United States and from abroad, and has provided material for scholarly papers, articles, dissertations, and books.

BARBARA OWEN

ORGAN MASS

Any set of pieces designed to fill in gaps in the Roman Catholic Mass or Vespers (evening service) that could also be improvised (Offertory, Elevation of the Host, and post-Communion). Specific pieces (versets) were composed to replace normally sung sections to be performed in ALTERNATIM with a chorus (Kyrie, Gloria, Sanctus, Agnus Dei). There are only a few works called "organ mass" in manuscript, but several composers wrote individual works that may be combined to fulfill the requirements of such a mass.

In Germany, the *Buxheimer Orgelbuch* (mid-fifteenth century) provides early examples of pieces, generally in the form of elaborated transcriptions. Similar works followed in the sixteenth century by Paul Hofhaimer, Arnolt SCHLICK, and Hans Buchner, then the Lutheran chorale-based works of Samuel Scheidt, Heinrich Scheidemann, and Dietrich Buxtehude, culminating with Johann Sebastian Bach's "German Organ Mass," comprising the eighteen chorale preludes (BWV 669–689) from the *Clavierübung* III.

Although the organ mass did not became widespread there, British composers produced examples in the mid-sixteenth century: Philip ap Rhys's Mass Ordinary (i.e., texts that appear in every Mass) and Thomas Preston's Easter Mass Proper (texts specific to a particular Sunday). Italy was more receptive to the genre; liturgical music by Jacques Brumel (a mid-sixteenth-century Flemish composer active there) led to the organ mass (1568) by Claudio Merulo, Italy's greatest Renaissance keyboard composer. Andrea Gabrieli (latter sixteenth century) and Girolamo Frescobaldi (*Fiori musicali*, 1635) contributed significant works of this type.

The organ mass was most prevalent in France, which regulated its liturgy closely through "ceremonials" (e.g., Paris, 1662), dictating the use of leader, chorus, and organ playing in the service. This was not a restraint for composers such as Jean Titelouze, Guillaume Gabriel Nivers, Nicolas-Antoine Lebègue, François Couperin (who wrote one mass for parish use, the other for monasteries and convents, both in 1690), and Nicolas de Grigny. Marc-Antoine Charpentier provided a written-out example of an alternatim mass, "Assumpta est Maria," in 1698–1702, with sections for ensemble and solo organ where required. The late eighteenth-century Revolution broke continuity for liturgical organ music. When the church was restored in the nineteenth century, approaches to liturgical writing were embodied in two composers: François Boëly, whose *Messe des fëtes solennelles* reflected his interest in Johann Sebastian Bach and Couperin, and Louis-James Lefébure-Wély, who applied a dancelike style to all genres, including liturgical works. Initially, Boëly lost the aesthetic struggle (and his organist's position); but Lefébure-Wély, once Aristide CAVAILLÉ-COLL's close friend, lost the latter's support and died young. Thus the path was opened for César Franck and his many followers. One interesting work stands outside all tradition: Erik Satie's Rosicrucian *Messe des pauvres* (1892–95) begins with a choral movement, followed by several organ solos, and simply ends.

The nineteenth century saw organ masses by Franz Liszt and Max Reger, but the genre had become regionalized, and was rarely the province of internationally known composers. Leos Janácek ("Glagolitic Mass") and Zoltán Kodály ("Missa Brevis") composed unusual forms of the alternatim mass. In the twentieth century, masses for organ alone have been composed by Leo van Doeselaar, Berj Zamkochian, Pekka Kostiainen, and Margaret Vardell Sandresky, the last based on the cantus firmus "L'homme armé." Messiaen, perhaps the most religious of contemporary composer-organists, expressed his beliefs in meditative nonliturgical organ music. But another reinterpretation of the organ mass, Arvo Pärt's *Annum per annum* (1980), is probably the most recorded organ work of the twentieth century.

RICHARD KASSEL

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ORGANO GRANDE

SEE GREAT; RIPIENO

ORGANOLA

SEE REED ORGAN

ORGANO PLENO

SEE PLENUM

ORGAN REFORM MOVEMENT

(Ger. *Orgelbewegung*, *Orgelgegenbewegung*, *Orgel-Erneuerungsbewegung*). A twentieth-century phenomenon, also known as the Organ Revival. The primary aim of this initially Alsatian movement was to reinstate the principles of "classic" organ building, then thought (especially in northern Europe) to consist largely of making an organ able to play the music of Johann Sebastian Bach in an "authentic" way. This required, in addition to mechanical KEY and STOP ACTIONS, that each DIVISION of the instrument, including the PEDAL, should possess a flue chorus. For instance, an ideal HAUPTWERK would begin with PRINCIPAL voices at

16', 8', 4', 2-2/3', 2', plus two Mixtures, one beginning with 2' pitch and another beginning at least a fifth higher, and include flute and reed registers of varying pitches and intensities. Initially, the work of Arp Schnitger was often taken as a model, as his instruments were held by many to be ideal for Bach. As the movement progressed, however, builders learned that many other factors had to be taken into account, if a true work of art in any of several styles was to result.

In Germany, the reform had begun with the publication of Albert Schweitzer's *Deutsche und Französiche Orgelbaukunst* (1906). In 1921, the first so-called Praetorius organ was built at Freiburg by Wilibald Gurlitt and Oskar Walcker; this experimental instrument had electro-pneumatic action, stop-channel windchest, and other compromises (destr. 1944). In 1954–55, another "Praetorius" organ was constructed (by Gurlitt and Walcker-Mayer), with mechanical action and design closer to that in Michael Praetorius's *Syntagma musicum* (Freiburg University; 3/27): a Werkprinzip approach, a slider-chest, and meantone temperament. (Only the case failed to match early seventeenth-century norms.)

Europe's great advantage lay in the existence of good examples of seventeenth- and eighteenth-century organ building, whereas in the United States almost nothing survived that predated the second half of the nineteenth century. There were a few handsome eighteenth-century facades (e.g., Boston, Christ Church), but usually the original instrument had been replaced. Even in Europe, what was called "restoration" amounted to rebuilding in an eclectic style. Some of this "modernizing" continued after World War II; as late as 1962, Norbert Dufourcq of the Commission des Orgues could write of "a compromise between the classical organ (Cliquot) and the Romantic organ (Aristide Cavaillé-Coll): this formula for the neoclassical organ has been unanimously adopted in France for thirty years." Some seventeenth- and eighteenth-century instruments, especially in France, lost their original character, with only a facade remaining.

In northern Europe, a relatively early example of a more careful attempt to return an organ to its original state—restoration rather than rebuilding—was the work done on the large 1723 Franz Caspar Schnitger organ at Zwolle, Michaelskerk, by the Dutch builder D. A. Flentrop (1955). From this point on, rebuilders were under increasing obligation to their "predecessors" when bringing a two- or three-hundred-year-old organ back to life, and many made a specialty of restoration. Other builders began to explore the "neobaroque" approach; a 1969 Schnitger conference in Groningen, Netherlands, provided a point of reference for these builders, who wished to build new instruments in a manner that their predecessors would have recognized, examined, and approved.

The availability of restored Baroque and other pre-Romantic instruments to be heard, played, and inspected by American builders and players after World War II had a profound influence on developments in the United States. The connection between these instruments and their repertoire began to be more clearly understood, just as better technical information about their design and construction was assimilated. A lively organ-building culture had existed in the United States well before 1850. During the latter nineteenth century, increasing affluence and a passion for new ideas and technologies caused older organs to be replaced frequently in churches. A growing concern for size and newness, together with the advent of electric action around 1900 (making it possible to scatter parts of an organ far from its console) caused the instrument to lose much of its identity. The popularity of the theater organ in the 1920s and '30s, designed to accompany silent motion pictures with orchestral sounds rather than to play organ repertoire, contributed to the confusion.

Two builders especially attempted to direct attention back to the organ as a unique instrument suited to its idiomatic repertoire: Walter Holtkamp in Cleveland and G. Donald Harrison at the Æolian-Skinner Company in Boston. In 1933, Holtkamp added a Rückpositiv division to the 1922 Ernest M. Skinner organ in the Cleveland Museum of Art. In 1936, Harrison, urged by E. Power Biggs, built an instrument he dubbed "Baroque organ-experimental," which was placed in the Germanic Museum (later the Busch-Reisinger Museum) of Harvard University, and used extensively thereafter by Biggs for broadcasts and recordings (1942–58). These gave many their first opportunity to hear a repertoire on approximations of "early" organs and sounds.

Both Harrison and Holtkamp continued to work for better tonal designs and placement of organs. However, except for a few mechanical action portatives built during the 1930s by Holtkamp, they both continued with purely electro-pneumatic action, although Holtkamp often built electro-pneumatic slider-chests for at least the Great division in his organs. Holtkamp's adamant insistence—that the pipework of his organs be wholly visible—resulted in strong architectural forms; but the absence of the housing or visual form provided by a case was antithetical to classical organ design.

In rejecting late-Romantic orchestral organs, Harrison, Holtkamp, and other American builders sought to devise "all-purpose" instruments, creating what came to be called the "American classic" organ. Designed to play a variety of repertoires, these organs combined German and French ideas (mostly of the eighteenth and nineteenth centuries), but with electro-pneumatic action and voicing appropriate to such windchests, and lacking the unifying characteristics imposed by mechanical action organs built into cases. While much of their work has already been altered or replaced, surviving large American classic instruments include the Harrison organ for the Church of the Advent, Boston (1934) and Holtkamp's instrument in Crouse Hall, Syracuse University (1950).

After World War II, other American firms followed the lead of Holtkamp and Harrison, but still with the limitations and approach to design associated with electro-pneumatic action. A deep understanding of any one valid historical style was still absent; these instruments reflected a combination of various eighteenth- and nineteenth-century characteristics, rather than the magical synthesis sought by the best builders. But Holtkamp and Harrison had much influence on other builders, paving the way for a more thoroughgoing revival of the traditional organ that would dispense with electro-pneumatic action, unencased pipework, eclectic dispositions (however carefully worked out), and inflexible WINDING, which had become "essential" by the early twentieth century.

In 1958, a mechanical action instrument by Flentrop, with a traditional disposition primarily based on early eighteenth-century ideas, replaced the 1936 Harrison organ at Harvard's Busch-Reisinger Museum. In 1974, a large mechanical action instrument by Flentrop, based on seventeenth-century Dutch style, replaced the Holtkamp instrument at Oberlin College's Warner Hall in Oberlin, Ohio. (Flentrop continued to exercise significant influence on the American reform movement until his retirement in 1978.) The substitution of relatively new electro-pneumatic instruments with encased mechanical action organs suggested that the eclectic American classic organ, for which both Holtkamp and Harrison had labored long and hard, was losing favor.

As the revival of traditional practices progressed, mechanical action builders in both Europe and America learned that many subtle factors, aside from disposition and action, were involved in producing a great musical instrument. Many institutions and performers in the United States and Canada were impressed by the sounds coming from European instruments. Well-respected European builders such as Rudolf von BECKERATH built instruments for North America (Cleveland, Trinity Lutheran, 1957; Montreal, St. Joseph's Oratory, 1960, Italianate style); others simply relocated to Canada (Gerhard BRUNZEMA, Gabriel Kney, Karl WILHELM, and Hellmuth WOLFF) and below the border.

While the quality of workmanship was often very high, many European and North American revival instruments came to be regarded, somewhat disparagingly, as neobaroque; the term *Baroque organ* had lost its meaning because of indiscriminate use. Although "correct" names were being given to all the stops, VOICING and SCALING overemphasized high pitches at the expense of 8' and 4' sounds. The dispositions were often found to be merely "rigid" without embodying the spirit of a particular style or era; actions, casework, and wind supplies were sometimes musically or technically unsatisfactory. Such defects strengthened the argument of those who claimed that the revival instruments were merely archaic, and did not encourage expressive playing.

By the 1960s, the influence of the purely Germanic *Orgelbewegung* and the neobaroque practices engendered by it began to be tempered by American builders' interest in other styles: the seventeenth-century French organ, soon followed by English, Italian, and Spanish instruments. Charles B. FISK sought to make an organ as versatile and expressive as possible without compromising its identity; he built extremely sensitive actions and freer wind supplies, and exercised a very judicious eclecticism in disposition, scaling, and voicing. He produced the first sizable tracker organ built by a twentieth-century American (Baltimore, Mount Calvary, 1961), based on Dutch models with registers from other styles. Of his large organ for St. Paul, Minnesota, House of Hope Presbyterian (1979), Fisk wrote, "This organ has the purpose of playing all music. To do this, it leans in three directions at once: seventeenth-century German, eighteenth-century French, nineteenth-century French."

The U.S. organ reform movement has produced many builders of the first rank, some of whom share Fisk's intention to seek a "delicate balance" among several styles, and others who prefer to make instruments clearly based on a single style.

See also **Neoclassical organ**

JOHN T. FESPERMAN

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ORGELBEWEGUNG

SEE ORGAN REFORM MOVEMENT

ORGUE EXPRESSIF

SEE REED ORGAN

ORLO

A Spanish reed stop of the regal class, similar to the Musette or Chalumeau. By the first half of the eighteenth century it was common in Spanish and Portuguese organs. Like many other Spanish reed stops, it was sometimes placed en chamade on the outside of the organ case.

See also **Stop**

EDWARD L. STAUFF

OSTFRIESLAND

SEE EMS-DOLLART REGION

OTT, MARTIN

German-born American organbuilder. Ott (b. Göttingen, Germany, 26 Apr 1944), whose father (Alfred Ott) and uncle (Paul OTT) were important organbuilders, apprenticed and worked for his uncle (1960–65, 1966–69), interrupted by a year at the HOLTKAMP firm. From 1969 to 1971 Ott worked as a voicer for Bosch Orgelbau in Kassel, Germany; he then moved to St. Louis, working as an associate of a Bosch representative, working east of the Rocky Mountains. In 1973 Ott restored the Holtkamp organ at St. Louis, Concordia Lutheran Seminary Chapel; he subsequently worked as a CASAVANT FRÈRES representative in the Midwest (1975–79).

Ott started his own workshop in his home in Kirkwood, Missouri, in 1972; the Martin Ott Pipe Organ Company, Inc., was formally established in 1973. Its first instruments were practice room and portative organs for St. Louis clients. The firm moved to St. Louis (1976), where Ott built its first 8' Principal organ with two manuals and pedal for the Trinity Lutheran Church of Kirkwood (1979). Ott moved to a new St. Louis workshop in 1980; His first three-manual organ was built for Northern Illinois University, DeKalb (1983). Yet another St. Louis workshop opened 1987 (enl. 1991); a three-manual, detached-console instrument was built for Omaha, Nebraska, Morning Star Lutheran (1988).

Except for four early electro-pneumatic instruments, Ott's instruments have all used mechanical action. The organs' designs are a straightforward interpretation of the WERKPRINZIP concept. Electric stop action and combination action are found on larger instruments. Mechanical action parts are of wood; all parts are built in-house, with the exception of metal pipework and electrical parts. Instruments are tuned mostly in equal temperament, voiced along classical lines, and have stable winding.

RICHARD KASSEL

OTT, PAUL (1903–1991)

German organbuilder. Born in Oberteuringen, near Stuttgart, on 28 August 1903, Ott apprenticed as a cabinetmaker in Memmingen, Bavaria. His education continued at the STEINMEYER workshop in Oettingen (1928–29); it was not until May 1930 that he passed the journeyman exam (he passed his master's exam in 1937).

Inspired by the early proponents of the German ORGAN REFORM MOVEMENT (*Orgelbewegung*), Ott was among those who became interested in reestablishing classical principles of organ building. Ott met with Christhard Mahrenholz, one of the Orgelbewegung's leading advocates, in Göttingen in 1930. Mahrenholz found a small cottage on the grounds of GIESECKE AND SOHN in Göttingen in which Ott could start his own business. At first, Ott performed repair work and worked occasionally for Hermann EULE in Bautzen. In 1930 he built his first organ, a continuo for Göttingen, Marienkirche.

Exhibitions at the Kassel Music Conventions made Ott known to north German musicians. By 1934, he had received numerous orders from conservatories, organists, teachers, and organ enthusiast. His experience in repairing older instruments in Lower Saxony led to several contracts for the restoration of historic organs in north Germany. Ott's restorations in Stade, St. Wilhadi (1937–38) and Cappel (1937–39) were among the first important rehabilitations before World War II.

After World War II, Ott continued his restoration work in Westphalia, with the assistance of Rudolf REUTER (Lemgo, St. Marien, 1947–50; Fröndenberg, 1951–52; Borgentreich, 1951–52), and Lower Saxony, aided by Alfred Hoppe (Norden, 1947–48; Stade, St. Cosmae, 1948–49; Cappel, 1950; Grasberg, 1950). He also trained his nephew, Martin OTT. Paul Ott died in Bovenden, near Göttingen, on 28 October 1991.

Ott was one of the pioneers of the Orgelbewegung. He tried to incorporate or adapt its tenets in a more moderate approach, while retaining historical concepts and practical realizations of its principles. He became a leading authority within the movement as a result of the interest in positives and continuo organs by the "youth music movement" (*Jugendmusikbewegung*).

Ott's tonal approach, with narrow scaling, low wind pressure, and minimal nicking needs to be understood as an effort against the extremes of the late-nineteenth-century Romantic organ. Ironically, this approach would lead to another extreme, which remained hidden from the majority of fellow organbuilders and musicologists for almost two decades. Other organbuilders preferred lesser extremes, although their instruments may not have achieved the quality and character of Ott's work. On the other hand, it is this particular style that complicates the conservation of Ott organs today. Ott's students (and their students) have carried his influence as far away as North America.

RICHARD KASSEL

OVERBLOWING

The effect of producing pitches that belong to the harmonic series (partials) of a fundamental, rather than the fundamental itself. It is sometimes a desirable result (see below), but often an effect to be avoided. Overblowing at the octave is the opposite of a STOPPED PIPE or HASKELL BASS, where the goal is to double the sounding length, rather than halve it.

In the orchestral woodwind family (including the flute, originally made of wood), playing in the upper partials is accomplished by increasing the force of the WIND PRESSURE produced by the performer. This is usually accompanied by the opening of a small fingerhole which eliminates the fundamental's chance to resonate by "canceling" (offsetting) its particular wave frequency within the pipe, thus securing the higher pitch. In the normal production of organ sound, a narrow scale and greater length encourage overblowing; but the air pressure required is considerable and the resulting tone shrill. Pipes with relatively wide scaling are therefore preferred for this purpose.

To achieve the overblown octave, a small hole or set of holes (node or nodes) are strategically placed in the pipe to encourage the desired frequency and discourage the normal (cutoff) frequency of the full-length pipe. A pipe must be twice the length of a normal pipe (e.g., an 8' length for a 4' register) to produce the pitches an octave higher. This principle is also used in MUTATION stops; there are even early examples of long, narrow 12' pipes overblowing at the third partial (twelfth) in northern Europe at the turn of the seventeenth century (Esajas COMPENIUS, Michael PRAETORIUS). More modern examples of overblowing at the twelfth include the Harmonic Gedeckt (Zauberflöte), a triple-length stop invented in the early nineteenth century.

The most common modern overblown stop is the HARMONIC FLUTE/FLÛTE HARMONIQUE also known as the Orchestral Flute, Traversflöte (Querflöte), or Flauto Traverso. Aristide CAVAILLÉ-COLL applied this term to a large-scale, open metal flue pipe that, in his opinion, imitated the orchestral instrument more closely, with fewer dissonant harmonics, greater sense of breath, ease of blending, and more power than other Flute stops. Building on this concept, Cavaillé-Coll invented the double-length reeds Trompette Harmonique and Clairon Harmonique, which, like other reed stops, depended on increased wind pressure for their effect and therefore did not require the offsetting hole to overblow. The French symphonic organ's sonority is strongly characterized by these stops, which do not play a significant role in other national building schools (except in the United Kingdom and the United States, where Cavaillé-Coll's ideas found positive reception early).

While the presence of partials can enhance overall harmonic color in a single pipe or in blending with others, imbalances between sufficient wind pressure, proper length, and necessary SCALING can cause (1) a failure to sound, or (2) a piercing tone. String stops, with their narrow SCALING, usually require VOICING adjustments. Bass pipes often suffer from similar difficulties, so it is imperative that wind pressure be sufficient to counteract thin or irregular sound. Another potential negative effect involves the Flûte Harmonique's potential for "drawing out" (influencing) other pipes. A 4' Flûte Harmonique (8' in length) can cause a nearby 8' Celeste to lose the smooth, built-in beating quality that produces its characteristic vibrato; distance and even barriers between ranks are necessary to avoid this effect.

Even post–World War II instruments have their vulnerabilities, in light of "anti-romantic" performance practice. In the name of authenticity, tempos were often sped up; pipes were voiced to speak more quickly. The requisite intense wind pressure increased the possibility of undesirable overblowing, heard at the point of attack as part of the CHIFF and articulation. The hard, poorly blending tones of different stops has led to greater care in voicing, in order to create Principals and other ranks that feature a warm, brilliant tone that develops smoothly and combines well with other stops.

See also **Acoustics; Pitch and Pitch Standards**

RICHARD KASSEL

OVERTONE SERIES

SEE PITCH AND PITCH STANDARDS

P

PACKARD ORGAN COMPANY

American firm of reed organ manufacturers. The Packard Organ Company was founded in 1871 by Isaac T. Packard (b. 1817), the son of British immigrants. With his brother Edmund (b. 1819) and his cousin Caleb, he had begun the manufacture of melodeons under the name Packard Brothers at Bridgewater, Maine, sometime before 1839. Edmund left the firm in 1862, leaving Isaac as the driving force of the company. A talented craftsman and inventor, he made many improvements in the REED ORGAN and held numerous patents for his innovations. Moving to Chicago, he set up in business as Packard, Keith, and Talbot. The Chicago Fire of 1871 led Packard to move to Fort Wayne, Indiana, where Isaac enlisted the aid of several investors, and in the same year the Fort Wayne Organ Company was established, with S. B. Bond (b. 17 Oct 1833; d. 20 July 1907) as president. The first Fort Wayne organs were produced by 1872; by 1899 the name of the firm had been changed to the Packard Organ Company.

Packard offered organs in a wide range of sizes and styles of superior quality, gaining a reputation for musicality of tone and exquisite workmanship. Unique to the Packard instruments were the 4’ Harp Angelica, a light string Celeste stop in the bass, and the 8’ Pipe Diapason, a separately housed treble stop. A notable feature, the Humanola, was a system of horizontal reed cell construction found in larger Packards in which one “cell” (small chest) was placed interconnected above the other, but with the reed only in the bottom cell. Both rows of cells were provided with a separately operated mute, thus providing tonal variety. In 1891 Packard produced an organ with the drawstops placed above and outside the panels at either end of the keyboard.

A device possibly unique to Packard was the “pedal bass” attachment. Designed for any organ that lacked pedals, it consisted of an enclosed independent windchest with bass reeds. At the rear of the pedal bass windchest was a hand-pumped bellows/reservoir combination to supply air to the bass windchest. The organ proper was placed upon the bass windchest structure; a windway connected it with the hand-pumped bellows. The pedals were placed at the front of the bass windchest and connected via pitman rods so that a bass reed would speak when a pedal was depressed.

S. B. Bond’s son, Albert S. Bond (b. 1863), joined the company in 1879, becoming general manager by 1886. Under his aegis the manufacture of pianos was introduced in 1893. Organ production capacity in 1900 was four thousand per month; manufacture continued probably until at least 1911. Piano production at Packard continued until 1938, when it was purchased by Story and Clark.

JAMES HOWARD RICHARDS

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PÁJAROS

See Nightingale

PALLET

See Windchest

PALLET AND BELLOWS

Any type of CONDUCTOR SYSTEM involving (1) the BELLOWS, a method of WINDING used from the medieval period through the late nineteenth century and revived in the post-World War II historicist era, and (2) a WINDCHEST with a pallet box and groove system, the basis for the slider-chest and spring-chest, and adapted during the pneumatic era; it also saw a revival of the original types during the authenticity movement.

PALLET BOX

See Windchest

PARALLEL RESERVOIR (SINGLE AND DOUBLE RISE)

A type of RESERVOIR comprising an open wooden rectangular frame for single (inward) or double (inward and outward) folds, made of wood (ribs and top board) and leather (folds). In the case of the feeder BELLOWS (at least two per instrument), air is pumped in with a foot pedal or lever; a pulley connected to the top board supports a cord that rises as the bellows empties, signaling the organ or assistant as to the air remaining. (This method would later be adapted to the REGULATOR.) In a parallel rise reservoir, the air is fed from a bellows (or, later, a BLOWER). In either case, the air raises the folds; as the weighted folds descend, the air enters the WINDTRUNK through the feeder. (Later, springs were used to control the descent.) The structure allows the pressure inside the bellows or reservoir to be directly related to the weight pushing it down. When the air is sufficient for the organ, the feeder closes and the exhaust valve opens, allowing excess air to escape. The folds are kept parallel through the use of external articulating rods, connected to one another and attached to the outer and inner extremities of the folds.

The original single-rise system was invented in the eighteenth century; its primary defect was producing a "bump" in pressure as the bellows or reservoir was emptying. A Scottish clockmaker, Alexander Cumming, developed the double-rise system in the mid-eighteenth century, with an equal number of outward and inward folds to stabilize the wind pressure through compensation. Cumming's invention became the model for the "modern" reservoir, well in place by the early nineteenth century, which survived the mechanical, pneumatic, electro-pneumatic, and electric phases of organ technology well into the twentieth century. Although the ELECTRONIC ORGAN eliminated the need for all such wind devices, the authenticity and restoration movements after World War II permitted the use of both systems where appropriate; in eclectic instruments of the period, the double-rise system was a frequent if sometimes anachronistic component.

RICHARD KASSEL

PASI

American organ-building firm. Martin Pasi began his career in 1976 as an apprentice in his native Austria with RIEGER Orgelbau. In 1981 Pasi moved to the United States to service Rieger organs. In 1982 he worked with Daniel J. JAECKEL in Duluth, Minnesota. In 1983 Pasi relocated to Quebec, where he worked as pipemaker and voicer for Karl WILHELM. In 1986 Pasi moved to Tacoma, Washington, where he was employed by Paul FRITTS. Pasi Organ Builders, Inc., was formed in 1990; it is located in Roy, Washington.

The Pasi workshop is small, producing approximately thirty stops per year. Virtually all components, including pipes, casework, keyboards, windchests, and bellows, are made in-house. Pipe scaling and voicing are rooted in historic concepts and procedures, adapted to certain aspects of modern technology. Pasi organs combine aspects of historic southern European organs with concepts not unlike nineteenth-century American organ building, taking in account the desire to match the client with an appropriate instrument. Among the opus list are the following instruments: Tavernier, Florida, Coral Isle Church (1992; 2/18); Lynnwood, Washington, Trinity Lutheran (1995; 2/29); La Mesa, California, First Church of Christ, Scientist (1997; 2/27); Spokane, Washington, St. Augustine Catholic (1999; 2/32); Bedford, New York, Bedford Presbyterian (2001; 2/29); and Omaha, Nebraska, St. Cecilia Cathedral (2003; 3/56, dual temperament).

DAVID DAHL

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Pasi Organ Builders, Inc. <http://www.pasiorgans.com/>.

PAUKE/TROMMEL

An imitative orchestral stop of considerable popularity from the sixteenth to the early nineteenth century. Low-pitched, large-scaled wooden pipes slightly out of tune with one another produced an aural facsimile of timpani being struck; when paired in an interval of a perfect fifth (e.g., D and A), an accompaniment was provided for military-style music with trumpet, fife, shawn, or other brash melody instrument, rather than the more solemn sacred music. In some instances a drum located within the organ is played by the organist depressing a pedal that causes the drum to be struck. This is particularly suited to military- or march-style music.

See also **Drum Pedal; Orage; Stop**

PEDAGOGY

The topic of organ pedagogy enjoys a symbiotic relationship with several other topics: construction, registration, literature, and technique; as organ construction evolved with changing technologies or tastes, new registrations, literature, and technique followed, complementing the new instruments. Organ pedagogy reflects these developments in the teaching of pedagogues and their method books, treatises, and other writings, not only in how they choose to teach, but in what they choose to teach (and what they do not). Most organ teachers and methods make the assumption that the new organ student has a basic keyboard background.

Europe: to 1800

Once the organ gained the ability to separate stops out of the BLOCKWERK, the concept of organ REGISTRATION began to emerge. Organbuilders were probably among the first organ teachers, as they often assisted organists in sorting out the possible and best registrations. In the fifteenth century, the first significant organ music appeared, as well as the earliest registration suggestions. Arnolt SCHLICK's *Spiegel der Orgelmacher und Organisten* appeared in 1511 in Germany, where the most significant innovations in organ building were occurring. Although not a method, this important text gives information on the typical organ of the day as well as suggestions for how preludes could best be adapted to it. It includes references to correct playing position at the console. This book was soon followed by Hans Buchner's *Fundamentum Buch* (ca. 1525), the first surviving treatise to offer instruction in organ technique. Topics include improvisation, fingering, and musical rudiments. Noticeably absent is any reference to pedal technique, although there is a brief discussion as to when the pedals may best be used.

Tastes in organ building, music, and registration were often specific, even unique to different national schools.The main common element in these schools was the use of "ordinary touch," which was more articulated (if not staccato) than later Romantic legato touch. In the process of achieving this touch, certain technical approaches needed to be taught involving both manual and pedal technique. It is helpful to remember that organ music has been closely related historically to other instrumental music. In earlier periods where there are few extant organ pedagogical sources, methods for other instruments can assist organ scholars in trying to re-create the approach and musical result that early organ teachers and players were seeking.

In his *Harmonie universelle* (1636), Marin Mersenne includes a Socratic dialogue on organ registration, in which an organist experiments with Mersenne's many possible registrations, listens critically to Mersenne's advice as to which are most successful, and then applies this guidance to selecting his own registrations. What Mersenne found pleasing in France, however, would not have met with artistic approval in other countries during the sixteenth and early seventeenth centuries. Spanish keyboardists published technical works for use with the organ, clavichord, or harpsichord. The most significant of these are the treatises by Juan Bermudo (*Declaración de instrumentos musicales*, 1555) and Tomás de Santa María (*Arte de tamer fantasia*, 1565). Composers sometimes offered pedagogical advice at the beginning of a compilation of musical works (their own or those of other composers); Hernando de Cabezón did this with his preface to his father Antonio's *Obras de musica* (1578). These documents illustrate what these men taught in terms of hand position, striking the keys, and fingering. Santa María also discusses Spanish ornaments, *quiebros*, and *redoubles*. Registrations for early Spanish organs could be found in sources like *Documents per a la historia* (Barcelona, 1613) and the *Archivo musical* (Lérida Cathedral). None of these treatises deal with pedaling, since few Spanish organs then had a PEDALBOARD. At the dawn of the eighteenth century, registration instructions included the use of Spanish EN CHAMADE REEDS (notably horizontal trumpet stops), which would have been of little concern to French or German organists at the time.

In the area of early Italian organ technique, Girolamo Diruta is the most important figure. *Il Transilvano dialogo sopra il vero modo di sonar Organi* appeared in two parts: the first part (1593) covered notation, scales, fingering, and ornamentation, while the second (1609) dealt with counterpoint, transposition, and other theoretical subjects. Like many early didactic materials, it takes the form of a Socratic dialogue (e.g., Antegnati's *L'arte organica*, 1608). Here, in conversation with a

Transylvanian student, Diruta explains how to move at the console before tackling the usual emphasis on fingering in these materials. Like Santa María, Diruta discusses how to play ornaments properly, in this case the *tremolo* and *groppo*. Unlike earlier Spanish treatises, part 2 of *Il Transilvano* includes Diruta's thoughts on registration, particularly how it relates to the twelve modes. This would have been particularly helpful for organists, since most early Italian organ music had no registration suggestions provided by the composer.

Early English pedagogical materials ignored the pedals, as that nation's organs had none until after 1720. English organists learned manual technique with the help of keyboard music collections, many extant from about 1530, which contain helpful fingerings consistent enough to be standardized for the student. Although much of this music is ostensibly for the virginal, it was written mostly by organists and easily played on the organ. English and Spanish fingering and ornamentation share many similarities, perhaps a reflection of the considerable interaction between these two courts in the late sixteenth century. Registration in England became standardized in the eighteenth century; by 1800, most music collections included didactic registration prefaces. Many organ tutors were published in England in this period, such as the widely known *A Practical Introduction to the Organ in Five Parts* by Francis Linley (1771–1800).

Like England, northern Germany and the Netherlands lacked pedagogical organ treatises; but as with virginal music, fingering in surviving manuscripts of the organ works of Heinrich Scheidemann, Samuel Scheidt, and Jan Pieterszoon Sweelinck, reflects a consistency that communicates how they played and presumably taught. Aspects of the fingering of English, Italian, and Spanish treatises are reflected in these works. It is curious that there is no discussion of pedal technique in any of the North German materials, the demands of pedaling had already evolved from playing simple, dronelike pedal points and slow cantus firmi to negotiating challenging independent parts. North German organists seeking instruction in registration had to rely on secondary sources like the preface to Michael PRAETORIUS's *Musae Sioniae* (1610) or the instructions included in Scheidt's *Tabulatura nova* (1624).

French organ performance had a heyday under Louis XIV. While there are no extant French classical organ methods, there are pedagogical writings provided by famous organist-composers who wanted to be sure that other organists played their own pieces properly (analogous to the standardization of French organ specifications during this period). Works by Guillaume Gabriel Nivers (1665) and André Raison (1688) are noteworthy for their tables of ornaments, an essential part of French classical organ playing. Works by these and other French composers invariably included a stoplist to help explain the registration references in the pieces (often in the titles as well), as well as "recipes" for combining stops to achieve select effects. *L'Art de Toucher le Clavecin* (1716) by François Couperin is the culminating treatise of this era. Like other significant pedagogical publications (e.g., those of Monsieur de Saint Lambert, Jean-Philippe Rameau), it is intended primarily for the harpsichordist, but resembles organ instruction sufficiently to be noteworthy. Posture, fingering, ornamentation, and *notes inégales* are explained and illustrated musically.

In eighteenth-century Germany, written accounts corroborate that Johann Sebastian Bach was a genius at the keyboard; the issue here is how he dealt with his students, who were of a more average ability. By piecing together primary source material, such as the copy of the *Applicatio* (BWV 994) with fingering in Bach's handwriting, and secondary sources, particularly from Bach's students (e.g., Carl Philipp Emanuel Bach, in *Essay on the True Art of Playing Keyboard Instruments,* 1753), one can get an idea of what J. S. Bach expected from his students. Bach's pedagogical approach to fingering was apparently on the conservative side, reflecting earlier fingering practices, whereas C. P. E. Bach's writings demonstrate that his father used more advanced or forward-looking techniques in his own playing, like increased use of the thumbs (including some thumb-under fingering). While there are accounts of J. S. Bach's dazzling pedal technique, there is very little information about his actual approach. It seems likely that he mainly used and taught the "alternating toe" approach, as recorded by his student Johann Christian Kittel (whose *Der Angehende Praktische Organist* embodies Bach's pedagogy), although being the maverick that he was, Bach undoubtedly used some heels in passages that require it. Bach left only a few general registration notes in his manuscripts; by all accounts, however, his students considered his approach innovative; he apparently taught by example.

Europe: the Romantic Era

While Bach combined both old and new practices, it was the new that became the basis of nineteenth-century organ technique. The Romantic era brought with it an explosion in organ pedagogy: the rise of organ schools, conservatories, master classes, and famous organ teachers, as well as more organ methods. The period saw a plethora of technological advances in organ construction, aided by the ability of organbuilders to travel farther afield to exchange ideas and sounds. This, of course, had far-reaching consequences in terms of registration practices and possibilities. The organist's repertory grew in parallel size and scope.

France and Belgium now became the focus of the organ world. The Paris Conservatory, organized in 1795, became a center of organ pedagogy, with a focus, particularly in the first half of the nineteenth century, on improvisation rather than repertoire and performance competition rather than church music. The famous slate of organ professors included César Franck (1872–90), Charles-Marie Widor (1890–96), and Félix-Alexandre Guilmant (1896–1911). The Brussels Conservatory began teaching organ in 1831 under the direction of François-Joseph Fétis, succeeded by Jacques-Nicolas Lemmens (1850). Lemmens became the leader of the modern "legato" school of performance; his first important pedagogical work, *Nouveau journal d'orgue à l'usage des organists du culte catholique* (1850), was succeeded in 1862 by his most significant method, *Ecole d'orgue basée sur le plain-chant romain*. This method represents the culmination of pedagogical trends since the late eighteenth century, as organ technique aligned itself with legato piano performance. Adopted by the Paris Conservatory, it was espoused by its renowned instructors, including Marcel Dupré and Louis Vierne. The method included a series of technical exercises and explanations, teaching the student to use finger substitution and heel-toe pedaling. Lemmens built on the foundation of important German methods from earlier in the century, especially those by Johann Gottlob Werner and Johann Christian Heinrich Rinck. Generally, organ pedagogy reflected trends toward less improvisation and greater emphasis on technique and historically accurate performances of organ repertoire. Other institutions in Paris were the Neidermeyer School (established 1853) and the Schola Cantorum (1896); both emphasized the training of church musicians, unlike the Paris Conservatory.

The United States

Organ culture, of course, began much later in the United States than in Europe. The first demonstrated use of an organ in a U.S. worship service was in 1703; many churches were still installing their first organs in the late 1700s and well into the nineteenth century. Many of the organists and organ teachers were imported from Europe; as organs gained acceptance, native-born organists were trained to fill these positions, as well as to learn appropriate repertoire and registrations for church use.

The earliest American writings dealt with the role of the organist as a player of hymns and accompaniments, such as a letter written by the eminent statesman, organist, and composer Francis Hopkinson in 1786. Hopkinson offers interpretive and technical suggestions and emphasizes the role of music in accompanying and interpreting the spoken and sung texts of the worship service. Although books on musical rudiments had been published earlier in the United States, Andrew Law's *The Art of Playing the Organ and Piano Forte, or Characters Adapted to Instruments* (1809) was the first method specifically published for keyboard players. This unique book uses a "shape-note" system to train organists to play from the same music as singers.

The pedagogical works of Artemas Nixon Johnson were significant during this era. His European training was reflected in his first important method, *Instructions in Thorough-base; Being a New and Easy Method for Learning to Play Church Music upon the Piano Forte or Organ* (1844). Like European methods, this presupposed some basic musical training, training organists to accompany service music. In the centuries-old European tradition, Johnson wrote significant instructional "remarks" for church organists in his 1852 collection *American Church Organ Voluntaries*. Many American volumes around the mid-nineteenth century included instructions on such topics as registration and appropriateness of music for sacred use.

There were no organ methods published in the United States at this time. Apparently the technique of church organists was strongly influenced by piano technique, which they probably acquired from mostly English and German sources, the most favored at the time. The most influential foreign method was Johann Christian Heinrich Rinck's *Praktische Orgelschule* (op. 55; 1819–21), which began to appear in English translations in 1835. It remained popular throughout the nineteenth century, setting the standard for "serious" American methods for the technical training of a well-rounded organist. This paralleled the interest in German organs and music during the second half of the century, and many American organists went to Germany to study. Later still, English methods like those of William Thomas Best (*The Art of Organ Playing,* 1870) and John Stainer (*The Organ,* 1880; several revisions through 1937) became extremely popular in the United States as well as England.

In the second half of the nineteenth century, America experienced an increase in the number of concert organs and organists; teachers and their pedagogical materials reflected this change. Organists were playing more voluntaries (a solo genre) in church, which became more complex and reflected more secular influences. In 1870, three well-known American organists, George Elbridge Whiting (*First Studies for the Organ*), Eugene Thayer (*The Art of Organ Playing*), and John Zundel (*The Modern School for the Organ*), published methods based on Rinck's model incorporating a comprehensive approach to organ pedagogy. The attempt to "legitimize" American organists and organ music by raising pedagogical standards had begun en masse; the establishment of music conservatories began in the late

1800s, and, as in France, several specialized schools such as the Guilmant Organ School (1898) in New York were established.

Guilmant was an especially significant figure at the turn of the century; he gave three American tours (playing at the St. Louis World's Fair in 1904), and his appeal as a teacher began to lure American organ students, who in the late 1800s would have studied in Germany, to France. This signaled a gradual switch of the major center of foreign influence. William Carl, American director of the Guilmant School, published a method in 1907. Comprehensive methods published by William Barnes (*School of Organ Playing*, op. 31, 1921) and Clarence Dickinson (*The Technique and Art of Organ Playing*, 1922) also reflected their French organ pedagogical influence; Barnes states that his method is based on the principles of the Schola Cantorum in Paris.

The first three decades of the twentieth century saw an avid interest in two new phenomena: the orchestral organ and the THEATER ORGAN. Clarence Eddy responded to the interest in orchestral organ building with his 1917 method, *A Method for the Pipe Organ*, which discusses topics like the relationship between organ touch and orchestral examples. Several specific methods were published in the United States and in England for the theater organ, such as Edith Lang and George West's *Musical Accompaniment of Moving Pictures* (Boston, 1920) and George Tootell's *How to Play the Cinema Organ, A Practical Book by a Practical Player* (London, ca. 1925). As institutional sacred music programs were being launched, schools for theater organists also appeared.

From the mid-1920s on there was a growing American interest in musicology. Organists became more interested in "correct" or authentic performance of organ literature, and the ORGAN REFORM MOVEMENT applied this idea to organ construction. Harold Gleason, a professor at the Eastman School of Music, was the first American to reflect this in his *Method of Organ Playing* (1937; eighth edition, 1995, with Catherine Crozier), which became a twentieth-century "standard." Gleason's conservatory method incorporates a stated goal of giving the student a historical survey of organ music from Conrad Paumann to Bach, with discussion of registration, ornaments, and (more recently) hymn playing. Aspects of church organ playing were also the focus of institutional programs beginning in the early twentieth century, such as the Union Theological Seminary in New York City and Westminster Choir College in Princeton, New Jersey (1926). The nineteenth-century French interest in improvisation is reflected in American methods as early as 1922 (Hamilton Crawford MacDougall, *First Lessons in Extemporizing on the Organ*). Considerable interest in this topic seems to have revived in the latter twentieth century. Several instructors have become specialists in teaching this subject; one of the best of them, Gerre Hancock, has written the useful *Improvising: How to Master the Art*.

The domestic organ has been an important area of organ pedagogy since the development of the REED ORGAN, which reached its peak between 1860 and 1900. Since this period coincided with the rise of interest in music in the American middle class and a surge in music publishing, countless methods were published for these organs, some designed for self-instruction. The reed organ was eventually displaced in homes and small churches by the ELECTRONIC ORGAN, which appeared in the 1930s. There are few methods geared specifically to electronic organs, since their technique and registration principles are the same as those of comparable pipe organs. There are some materials geared specifically to Hammond organs, which use a unique draw-bar system and require a totally different registration approach. There is a whole body of methods for playing the HOUSE ORGAN that was published after World War II. Some methods use alternative playing systems like reading chord symbols rather than notes; others address idiosyncrasies of smaller home organs like the short pedalboard or KEYBOARD, rhythm units, or chord buttons.

The second half of the twentieth century saw a diversity of excellent organ methods and educational programs in which to study organ. Three trends perceptibly impacted organ pedagogy: an increased interest in performance practice, a growing incorporation of technology, and an increasing concern for having sufficient classically trained organists available for church positions. Two important books, by Soderlund (1986) and Ritchie and Stauffer (1992; see bibliography), address the topic of organ performance practice through the study of historical periods, the literature, and available sources. Even teachers who do not espouse such a dramatic separation of types of technique now incorporate some of the general principles illustrated in these texts.

Recent organ technologies have had a impact, both in vast improvements to organs that produce their sound digitally and in new embellishments to pipe organs. Built-in digital recording systems allow teachers to "record" performances, complete with stop and dynamic changes, into organs for students' later reference; alternatively, students can record themselves in a lesson and play back what they had performed later. Many professional organizations such as the AMERICAN GUILD OF ORGANISTS (AGO) have traditionally offered continuing education opportunities to organists in the form of live master classes and workshops. These now offer websites full of information, as well as resources such as master classes on DVD. The Organ Historical Society's website provides an excellent list of organ resources, including methods and instruction books and videos. Still another use of computer technology may be seen in computer-assisted learning, such as that developed and marketed by Don Cook in his "Organ Tutor" computer program.

Finally, the concern about the future of classical and sacred organ music has driven the direction of organ pedagogy in many ways. The AGO and some denominational organizations sponsor "Pipe Organ Encounters," lasting from several hours to several days, which offer non-organ keyboard students a chance to be introduced to many aspects of organ playing in group, sometimes one-on-one presentations and lessons. There are websites that teach organ basics in an attempt to interest students, such as the Pipe Organ Education Project. Significantly, organ teaching materials have been finally been published that no longer assume a piano background for beginning organ students.

See also **Fingerings, Historic; Performance Practice**

SALLY CHERRINGTON BEGGS

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PEDAL

The Pedal division, while not as old as the Great or Positiv, has a very curious and complex history. The first scheme to provide a bass note without using the fingers was a simple hook or lever to latch down a low manual key for a drone bass. The first true pedals (fifteenth century) were a far cry from the PEDALBOARD of today, consisting of wood "mushrooms" or short stubs played with the toe. (Heel-toe pedaling was several hundred years away.) These first pedals were nothing more than PULL-DOWNS from the HAUPTWERK; no separate pedal RANKS were available. The pedal COMPASS was very small, starting out with three or four stubs, gradually increasing to eight, and so on, until a thirty-five-key pedal keyboard, or pedalboard (from F, starting with a short octave), was reached in some French classical organs.

The pedalboard was usually flat and straight until the mid-nineteenth century, when concave and radiating pedalboard types were combined in England by Henry WILLIS (1855); this hybrid eventually made its way to the United States, and became the AMERICAN GUILD OF ORGANISTS' standard in 1903. The concave and radiating pedalboard was never popular in continental Europe, which continues to favor the flat and straight variety, but a few instruments allow for interchange between the types.

The Pedal DIVISION's tonal design has varied over a wide range. When separate pedal ranks appeared in the fifteenth and sixteenth centuries, the specifications were, in some organs, limited to a few 8' ranks; others had a single 32' or 16' and a scattering of other registers. This experimentation gave way to thoughtful, large-scale design; complete Pedal divisions compatible with the KEYBOARD in size and tonal design were common fifty years before the birth of Johann Sebastian Bach, including upper work. As the Baroque chorus ensemble gave way to the Romantic emphasis on 8' stops, the Pedal had by the early twentieth century lost all of its upper work, and 16' and other ALIQUOT stops predominated. Even coupling from pedal to manual was less effective than before, as upper work on the manuals tended to disappear as well. By the 1960s, neoclassical tonal design had resurrected both the pedal stops necessary for greater musical versatility and the appropriate manual designs for good balance.

No other instrument places such musically demanding requirements on the feet, and in no other instrument are such acts of coordination demanded nor such stunning musical effects available from them. The organbuilder is challenged to provide an appropriate and workable arrangement of ranks for the Pedal division. Large pipes tend not to speak as quickly as smaller pipes; they have a more pleasant sound if they are not goaded into speaking too quickly during the VOICING process. But large pipes are the essence of the Pedal division, and they must have some coordination with the smaller pipes as well as with the manuals.

Over time, the Pedal division has been remarkably inconsistent from one country to another. Northern Europe seems to be the home of its earliest development into full-scale prominence; the Low Countries, Germany, and their nearby neighbors brought the Pedal to a highpoint by the late Renaissance, and such complete divisions remained a mainstay of the pipe organ there. Italy, Iberia, England, and North America were late in bringing the Pedal to full application.

The Pedal is the most difficult division to focus, since its pipes are large and spread over the entire organ. By comparison, a BRUSTWERK will have focus simply because it is an array of pipes occupying only a few cubic feet. If one desires focus for the Pedal, then it must be small and carefully located as an entity. In the largest pipe organs the Pedal might reach almost twice the number of DRAWKNOBS as any manual division, and the physical space necessary to house the immense pipes might be as large as that of all the manual divisions combined. Large pedal pipes are costly, consume great quantities of WIND PRESSURE, and require a large WINDCHEST (often in the form of a PEDAL TOWER) and supports. This means a great expense, and only the most careful design will avoid waste while maximizing musical success. A large Pedal is costly but the musical deficiencies caused by an inadequate design are always disappointing. The return of broadly based and flexible designs has encouraged musicality and diversity of use, providing both a challenge and reward for the organist.

CHARLES HENDRICKSON

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PEDALBOARD

The manual located on the floor of the CONSOLE, played by the toes and heels (balls) of the organist's feet, incorporating the PEDAL division and its associated ACTION and WINDCHEST mechanisms. Before an actual pedalboard existed, keys could be held down by hook or lever to produce so-called pedal tones. A desire for greater variety flexibility led to the earliest "pedalboard," comprising a small number of toe stubs operating wooden, sometimes keylike levers; the heels of the feet were not yet employed. The levers were connected to BLOCKWERK or other pipes, using PULLDOWNS directly to manual keys or pallets, and, later, "transmission," where pedalboards were connected via splayed BACKFALLS to their corresponding manual pallets. Gradually, the COMPASS of the pedalboard grew; by the fifteenth century it had its own stops; by the next century, the Pedal division, with its own CHESTS (often in the form of PEDAL TOWERS), was in place. Pedalboard stops were by no means exclusively in the lowest registers, nor were their pipes located in one chest; there might be at least two chests, one to each side of the console, or might be spread among other divisions. The only necessity was to account for larger pipe sizes, and even that would not inhibit builders who developed stopped pipes and similar space-saving devices.

Where the pedalboard developed first (northern Europe), its function was to perform the cantus firmus, the descendant of the slow-moving medieval "tenor," that served both sacred and secular pieces as a starting point in the Renaissance. As homophonic textures began to replace contrapuntal ones at the turn of the seventeenth century, the pedalboard began to carry the melody line, a tradition that continued through the chorales of Bach and the Lutheran organ school.

The Baroque basso continuo part doubled by the organ became increasingly virtuosic, serving as impetus to further developments in pedalboard design. Rectangular frames and straight keys became commonplace in the sixteenth century. Pedalboard keys were made narrower relative to the spaces between them, allowing for the development of toe-to-toe, then hell-toe foot motion. Pedal became true levers, with a fulcrum at the back end of each pedal, hidden by the console CASE. Round studs at the front end of pedals, playable by toe or ball, eventually gave way to a more manual-like design as the Baroque and classical eras progressed. Two arrangements of white and black keys became prevalent: one, anticipated as far back as the Halberstadt manual (1361), where shorter black keys were set above and independently of white keys, and two, in which black keys remained shorter than their white counterparts (a 1:5 ratio, according to Arnolt SCHLICK, 1511), but resting on levers equal in length and depth to the white keys. A norm of thirty to thirty-two pedals was established, and the Pedal division became increasingly the terrain of lower-register stops and the "bass line."

While continental builders continued to use the relatively shallow, flat pedalboard almost exclusively, two developments came together in nineteenth-century England under a patent belonging to Henry WILLIS (1855). The first was to make the pedalboard concave, so that the keys rose gradually, outward from the center, making the end keys the highest and therefore easier to reach from the bench. More complicated was radiating the pedalboard by extending the keys gradually, outward from the center. The effect is that of a gentle angle that brings the end keys closer to the player, although the levers themselves must grow longer the further from the center the pedal is located. The combined design was taken up by American as well as British builders in the nineteenth century, and it is the standard found in THEATER ORGANS in both countries; but classical pipe organbuilders there were less unanimous in their acceptance. The post–World War II authenticity movement brought German and other older European traditions to bear on American organ building, so that a performer touring the United States must be prepared to play on pedalboards that are flat (likely on new instruments), concave but nonradiating, radiating but flat, or radiating and concave.

RICHARD KASSEL

PEDAL CHECK

A foot lever that shuts off the PEDALBOARD mechanically—that is, prevents the pedal keys from moving. Not a widespread device, its usefulness is limited to works (or sections of works) that do not require use of the pedal manual, a "safety" in case the organist's feet should wander during moments of concentration elsewhere or, as more than one wit has suggested, experience a lack of focus during lengthy sermons.

See also **Mechanical Aids**

PEDALITER

A quasi-Latinism (from *pedalis*, for the feet) of unknown origin that Arnolt SCHLICK used in opposition to MANUALITER, referring instead to the part written for the feet in combination with the manuals. Often the piece is in several parts, as in Samuel Scheidt's descriptive "*Benedicamus à sei voc* [*es*] *pleno organo pedaliter.*" A composition bearing this word in the title may refer to music with an elaborate pedal line, or simply a piece in which the bass carries the chorale melody. The *Pedalexercitium* (BWV 598) that Carl Philipp Emanuel Bach created to demonstrate his father's improvisational approach is simply that: an exercise, not a "pedaliter work."

FERDINAND J. DE HEN

PEDAL TOWER

Traditionally, the tallest CHEST or chests found in organs from the fifteenth century on, most often shaped like a ornate round tower (in less elaborate instruments, flat or pointed) and relatively narrow when compared with other chests. Usually the tallest pipe appears in the center of the tower, although the cornice (upper woodwork) or pipe shades of the tower chest may create that impression. At first the tower did not contain only PEDALBOARD pipes, and many of the 16' pipes were part of the HAUPTWERK (and occasionally other) divisions; but as 32' (and 64') stops became a part of the PEDAL division, the tower became the natural location for its pipes. In some instruments, DISPLAY PIPES were used.

In the archetypal image of large organs, there are two towers, one to either side of the CONSOLE. The larger the organ is, the further out on the "wings" the towers are (although not always furthest from the console). But in some smaller instruments, especially in the Renaissance, there was one tower, located in the middle. By the seventeenth century, the Pedal division on cathedral instruments was often divided into three chests (one central, two on the wings), with other pipes (e.g., Solo flute or reed stops) to be used for pedaled chorale melodies and similar purposes. Eventually lower-register stops came to monopolize the pedal towers (eighteenth and nineteenth centuries); the resulting emphasis on the bass meant a loss of versatility.

The Romantic pedal tower took on the period's neogothic designs while continuing to function as the foundation for Western music's harmonic-contrapuntal scheme. In the post-Romantic organ reform era, especially after World War II, builders returned to Baroque and Renaissance models, scaling down all elements. The single tower chest reappeared, resting once more in the center, in front of the console and above the performer.

RICHARD KASSEL

PERCUSSION STOPS

Stops that imitate the sound of percussion instruments such as timpani, drums, bells, cymbals, triangle, tambourine, and the like. The sound is produced either by real instruments incorporated into the organ or imitated by organ pipes.

The earliest percussion stop was the PAUKE/TROMMEL (or DRUM PEDAL). This device, first mentioned around 1500, remained in use as late as the nineteenth century, by then mostly in Italy (Tenda, Serassi organ, 1807). Sometimes the sound was produced by only two pipes (mostly C/C#), a cluster that produced the inharmonic tones consistent with membranophones. The Pauke stop's pitches were often "tuned" in fifths (C/G or D/A) to be used with trumpets in militaristic music. This culminated in imitations of "Janissary music," the European interpretation of Ottoman bands of the seventeenth and eighteenth centuries.

German-speaking and Slavic countries favored the imitation of percussion sounds by pipes. Jacob ADLUNG (*Musica mechanica organoedi*) felt that real percussion instruments should not be integrated in church organs. However, percussion instruments were placed in some organs, especially in Italy. Sometimes these were placed inside the case, other times on the facade, where they might be played by movable putti, mostly angels or musicians. On occasion, timpani-playing figures were combined with others playing trumpets, familiar in central Europe (Joachim WAGNER, Berlin Garnisonkirche, 1724–25; Eugenio CASPARINI's "Sonnenorgel," Görlitz, 1704).

In France the ORAGE (thunderstorm) was used during the eighteenth and nineteenth centuries; even Aristide CAVAILLÉ-COLL incorporated it in some of his great organs, for example Notre Dame, Paris (1868). For this stop the lowest pipes C to G# of the 32' and 16' were blown all together successively. He included it also in the outline for a monumental organ for St. Peter in Rome (1875) never accomplished. The Joseph GABLER organ in Weingarten, Germany, St. Martinus (1737–50) had a stop, "La force," sounding a kind of pedal Mixture with forty-nine pipes on low C.

Most percussion stops were incorporated in large organs, but were sometimes found in smaller instruments. German organbuilder Johannes Baumgartner built a positive for Siebenbürgen, Rumania (1752). Besides seven standard stops, the instrument had a ZIMBELSTERN, Cuckoo, Vogelgeschrey (BIRD WHISTLE), and Pauke, tuned to 4' C/C#.

There are very few written sources calling for the use of percussion stops. In Italy from the end of the eighteenth century onward, *sinfonie* or *sonate* were composed with percussion stops, but this was exceptional. Authors of nineteenth- and twentieth-century organ treatises doubted the musical quality of these stops; George A. AUDSLEY referred to them as "one of the curiosities met with in old Organs."

Percussion stops in organs were paralleled in the early nineteenth century by the presence of the "Janissary music" stop (It. *banda militare*), especially in Viennese pianos. Despite this, few sources mentions this kind of stop. Although percussion stops in organs and pianos were outmoded from the 1850s, they never disappeared entirely, except in urban church organs.

Percussion stops, more often connected to real instruments than imitative, were the province of MECHANICAL ORGANS, whether the WATER ORGANS of Luca BLASI and others, the impressive automata of Thomas DALLAM, or ingenious clockworks. Larger PLAYER PIPE ORGANS such as the barrel organ, band or fairground organ, carousel, and calliope employed percussion stops as a matter of course, although domestic instruments were certainly able to adopt such stops. Orchestrions utilized percussion as required by the orchestral repertoire they were attempting to translate into keyboard music. The "monster organs" of the post-Romantic United States included percussion as part of their sheer immensity (the "Spreckels Organ," San Diego, Balboa Park; Austin, 1914–15). Percussion stops have found a home in THEATER ORGANS since the 1920s.

See also **Sound Effects; Stop; Toy Stops**

CHRISTIAN AHRENS

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PEREIRA, TOMÁS SANCHO (1645–1708)

Portuguese missionary and organbuilder. Born near S. Martinho de Vale, Pereira entered the Jesuit order in Coimbra (1663), where he studied math, astronomy, and music. In 1666, he was sent to India as a missionary; at some point, he traveled to Macao, where he attended the University of S. Paulo to earn an arts degree. He may have studied organ building there, or at least taught himself the necessary skills. In 1673 Pereira went to China, invited by the emperor Hsüan-yeh (reigned 1661–1722), who was impressed by the arts and technology of the West. Pereira designed and built an organ in Beijing; in 1679 he was called to the court, which he amazed with his transcriptions of Chinese melodies by ear; he may also have performed polyphonic music. Pereira built a second organ (presented to the emperor in 1681), composed hymns in Chinese, and coauthored a multivolume treatise on music that was translated into Chinese. Pereira was instrumental in getting Chinese leadership to permit Jesuit missionaries to work there (decrees, 1692, 1707; reversed because of papal interference, 1717). His instruments were probably the first European organs to be installed in China. It is notable that he was an amateur builder; that he served a religious order that was unsympathetic to music at the time is remarkable.

RICHARD KASSEL

PERFORMANCE PRACTICE

Performing a composition as the composer intended it to be performed, insofar as that can be determined. For contemporary music, this often means consulting the composer or the person who gave the first performance. For music of earlier times, this requires studying such indirect evidence as treatises, writings of the composer (or of similar composers), prefaces, performance statistics, extant instruments, iconographical evidence, and other related information. From the late nineteenth century on, this may also include piano rolls and sound recordings.

The chief aspects of performance practice for the organ include notation, ornamentation and improvisation, figured basses, tempo, rhythm, phrasing and articulation, dance rhythms, tuning and temperament, fingering and pedaling, and registration.

Notation

Although most modern editions provide no major problems regarding the notes, accidentals may have to be added in ornaments when a passage goes through harmonic areas not specified by the key signature, such as in the closing section of the Johann Sebastian Bach G-Minor Fantasy (BWV 542). The division of notes between right and left hand may be influenced by beaming that has been changed, as seen in the opening of the C-Major Toccata (BWV 564) as given in the original Bach Gesellschaft edition and the *Neue Bach-Ausgabe*. Music for which the original is lost and secondary sources must be relied upon poses special editorial problems. This is the case with Dietrich Buxtehude's organ works; there are as many solutions for any major piece of this composer as there are (several) twentieth-century editions. Compositions for which the composer made multiple versions, such as some Franz Liszt organ works, invite—indeed, require—performers to make a choice.

Ornamentation and Improvisation

Ornamentation in organ music before around 1800 is usually indicated by stenographic signs, the interpretation of which can be determined from many published prefaces, particularly by French composers. Although trills on the beat, beginning on the upper note, are standard in most Baroque organ music, much musicological effort has been expended in proving otherwise (see Neumann).

Additional ornamentation might well be improvised, especially in music of Italian derivation or in works that predate the use of notated signs. Improvisation may also be called for when a fermata occurs in a deceptive cadence, as in the ending of the Bach Passacaglia (BWV 582), or when a tonic chord in second inversion (with or without a fermata) signals a cadenza, shortly before the conclusion of a concerto movement.

Figured Basses

In Baroque music, a special instance in which improvisation is required is the presence of a bass line having figures which denote certain harmonies not otherwise notated. The practice of such basso continuo (thoroughbass) realization requires the provision of the specified harmonies and may suggest the improvisation of accompanying melodic figures appropriate to the texture. Realization of the bass line may also be necessary in passages (or even complete works) that are not figured, particularly in music of the late sixteenth and early seventeenth centuries. This practice is required in virtually all ensemble music from around 1600 to around 1750, but is seldom needed in solo works. Figured bass realization was gradually abandoned after the Baroque period, lasting into the early nineteenth century only in the accompaniments to sacred choral music.

Tempo

Specific tempos are seldom indicated before the late eighteenth century, the range of appropriate tempos for a given piece being determined by the character and style of the piece. Italianate tempo designations begin to be introduced in the eighteenth century and are common in most music after that. The speed implied by a particular term, such as andante or allegro, varies according to time and place; thus research is often required to reach the proper conclusion.

Rhythm

Rhythmic problems in the Baroque period occur mainly in French music, where the application of rhythmic inequality is frequently appropriate; writers stress that *notes inégales* are the norm rather than the exception. When simultaneous duple and triple figurations must be resolved, the second of two duplets will usually be played with the last of three triplets; other situations, determined by the motivic context, will call for two against three.

Rhythmic freedom certainly occurred in music of this period from all nationalities but is not specified except in the most general ways, often by the title or form of the composition. Music that is improvisatory in nature—the *stylus fantasticus* of northern Germany, the sectional toccatas of Italy, or the *préludes non mesurés* of France—lends itself to freedom more than a strict imitative texture does. In the prefaces to his keyboard works in the early seventeenth century, Girolamo Frescobaldi stressed the need for rhythmic freedom.

Phrasing and Articulation

Phrasing in Baroque music was often implied by motivic construction, by imitative subjects, and, in the case of chorale-based works, by the placement of fermatas at the ends of phrases of the cantus firmus. Such signs of articulation as dots or dashes are uncommon before about 1750, but writers of the period indicate that a non-legato style was the norm in keyboard music. The opposite became the case in the nineteenth century, when legato was assumed, usually being indicated by phrase marks. Continuous legato as the norm seems to have originated with French organists of the early twentieth century.

Dance Rhythms

Appropriate articulation is heavily influenced by the dance rhythms that were pervasive in much Baroque music. Dance rhythms were especially prominent in the organ books of French composers, but also permeated the music of other nationalities and styles, including chorale-based works. The choreography of dance patterns suggests motives that require articulation, even when the music in question was not given a dance title and was not intended to be danced.

Tuning and Temperament

Tuning standards varied greatly before the twentieth century. Pitch levels were generally lower than today, usually by at least a half step, although they were sometimes higher in certain geographical areas. Equal temperament was not universal until the late nineteenth century, although theorists spoke of it earlier. MEANTONE TEMPERAMENT was the norm until the late seventeenth century, when unequal temperaments ("well temperaments") that nevertheless permitted playing in all keys were introduced.

Fingering and Pedaling

The foundations of modern fingering were laid in the latter half of the eighteenth century. Prior to that time, the thumb was seldom used, and attention was given to the remaining fingers as being either "good" (i.e., strong) or "bad" (weak). Most theorists considered the "good" fingers to be 2 and 4, although 3 and 5 were occasionally so designated.

The layout of most pedalboards prior to the nineteenth century, as well as the shapes of the keys, dictated that notes usually be played by the toes. Very short keys, such as those found on French and Spanish organs, could be played only by the toes in non-legato style. Longer natural pedal keys permitted the use of the heels. The use of alternating toes and heels, commonly accepted now, originated in the latter part of the nineteenth century in the school established by Jaak Nikolaas Lemmens and was further refined by the French school of the early twentieth century.

Registration

REGISTRATION, the selection of organ stops on which a composition will be played, varies greatly from one time and place to another, as well as within a given locality. In terms of composer directions, three procedures can be identified. The first is to indicate little or nothing, leaving the registration up to the informed choice of the performer. This is the norm for most music before the nineteenth century, as well as for some more recent music. Bach left a few indications in a handful of compositions, but these must be reconciled with what we know of the general principles of the time. Some twenty-first-century composers give minimal indications, such as which hand should be played on which keyboard.

A second technique is to give generic registrations ("Principal Chorus," "Reed Solo," etc.) or dynamic levels, with the understanding that they must be rendered consistent with the resources of the organ at hand. This is the situation with a great deal of music from the late nineteenth century on. A similar instance is found in French Baroque music, with compositions having such titles as "PLEIN JEU," "Tierce en Taille," or "Flûtes," all indicating a generic combination of stops associated with specific textures and styles that would have been well-known to contemporary organists.

A third method, of relatively recent origin, is to give very specific registrations applicable only to one particular organ. This is the case with Olivier Messiaen's compositions, which were conceived for the Aristide CAVAILLÉ-COLL instrument he played at La Trinité, Paris; in the published editions and in directions given to performers he coached, the composer sanctioned modifications that allowed the works to be performed on other organs having differing sounds. An entirely different situation obtains with Arnold Schoenberg's *Variations on a Recitative*, which is unplayable on any organ without making modifications, owing to misunderstandings about the nature of pitch levels and keyboard ranges. Such a level of specificity does not apply to any organ music of earlier times.

Even when registrations have been determined for music of earlier times, there can be problems in reconciling the historic timbres with more modern ones. Thus, the Principal chorus of a SILBERMANN organ from Bach's time will sound quite different from the same chorus on an ÆOLIAN-SKINNER organ of the 1950s or from the same chorus on a modern replica of an earlier instrument. Likewise, the Cornet combinations available on a CLIQUOT organ of the late eighteenth century will not sound like the same stops on a Cavaillé-Coll instrument of the late nineteenth century, nor will they coincide with a twenty-first-century recreation.

To the problem of reconciling the differing timbres of various times and places, there is no easy answer. Familiarity with the organ-building styles of the music in question will help. Beyond that, knowledge of the texture and style of the music will assist. For instance, contrapuntal works by composers like Bach can be rendered musically on many registrations far removed from their time of inception. On the other hand, music that is largely dependent on tonal color for its effectiveness, be it Joan Baptista Cabanilles or Francois Couperin, will be best served by registrations similar to the originals.

See also **Fingerings, Historic; Iconography; Pedagogy; Pitch and Pitch Standards; Tuning and Temperament**

ARTHUR LAWRENCE

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PERIODICALS

The discussion of key organ periodicals that follows is broken down by region. Some current or recently published journals have placed indexes of articles on the World Wide Web.

Europe

Germany

One of the first journals in Europe that focused on organ culture was the German magazine *Urania* (est. 1843). It was founded by Gotthilf Wilhelm Körner, and Alexander Wilhelm Gottschalg served as editor from 1865 until his death in 1908. Gottschalg decided to give more attention to "all organ playing and the new fashions in the field of organ building." To prevent one-sidedness, *Urania* also contained articles about music theory, church music, and piano playing (according to an 1893 announcement). At the beginning of volume 66 (1909), when Max Beckmann was appointed editor, the subtitle was changed: "Gesang- und Clavier-Musik" became "Vokal- und Instrumentalmusik." *Urania* was published once a month until it ceased publication in 1911. Whereas *Urania* paid attention to more aspects of musical life than just organ matters, the *Zeitschrift für Orgel, Clavier-, und Flügelbau* (1844–55) focused more on organ-related topics. The first journal exclusively devoted to the organ was *Die Orgelbauzeitung* (1879; ed. Moritz Reiter). The title was changed to *Die Orgel- und Pianobau-Zeitung* (vol. 3, 1881). The aim of the *Zeitschrift für Instrumentenbau* (1880), according to editor Paul de Wit, was to cover a wide variety of aspects of instrument building. After protests, De Wit declared, "We will pay special attention to organ building and have found competent correspondents." The *Zeitschrift* became *Instrumentenbau-Zeitschrift* in 1943; by that time, it had lost its significance for organbuilders and organists. Other magazines focused on the performer: *Der Organist*, founded by Otto Wangemann (1880; only twelve issues). A journal with the same name became the journal of the Allgemeine Organisten-Verein (1895–1904). Interesting as well in this respect is *Die Orgel* (1889–97, 1909–14). To complete the historic picture, an important general journal should be mentioned: *Die Musik*, established in 1900 (after several title changes, it was combined with other journals in 1943). Albert SCHWEITZER published the articles that eventually constituted his famous booklet *Französische und deutsche Orgelbaukunst und Orgelkunst* in this journal (1905–06).

Many new journals were introduced in the twentieth century. Some of them focused on church music: *Musik und Kirche* (1929; ed., among others, Christhard Mahrenholz); *Gregoriusblatt* (1932–44, renamed *Die Kirchenmusik* in 1938), although another magazine had already the same name (published by the Landesverband evangelischer Kirchenmusik); and *Der Katholische Organist* (1913–33, renamed *Monatshefte für katholische Kirchenmusik*, 1920). Other periodicals focused on other organ-related topics, such as the *Mitteilungen der Max Reger-Gesellschaft* (1921–41) and *Mitteilungen des Max Reger-Instituts* (1954). Strictly organ-related journals published today are *Ars Organi* (1952, the journal of the GESELLSCHAFT DER ORGELFREUNDE, which also publishes the annual *Acta Organolica*); and *Organ: Journal für die Orgel* (1998) published by Schott; it recently took over *Orgel International*, a high-end journal on organ art (1997–2002).

Austria and Switzerland

Along with the German journals, both Austria and Switzerland have benefited from organ-related magazines of their own. Austria has had the *Zeitschrift für Orgel- und Harmoniumbau* (1903–11), published by the Verein der Orgelbaumeister Österreichs, an initiative of organbuilder Matthäus Mauracher; and the *Organisten-Zeitung* (1924–26, a publication of "der freien, unabhängigen Organisten-Vereinigung"). The leading Austrian journal today, which began as *Das Österreichisches Orgelforum* (1975), was renamed *Das Orgelforum* in 1998 to gain more international attention. In Switzerland, the Schweitzerische Reformierte Organisten-Verbände published *Der Organist* (1923–46, taken over by *Musik und Gottesdienst*, 1947). *La Tribune d'Orgue Suisse* serves the French-speaking readership in Switzerland.

The Netherlands

The Netherlands magazine *Caecilia* (1844–1944), although subtitled "Algemeen Muzikaal Tijdschrift van Nederland," took over various magazines during its existence that paid attention to organ matters. Other music journals paid attention to organ matters as well, such as *De Kerkmuziek* (1879–80) and *De Harp* (1906–15). The first periodical dedicated solely to the organ was *Het Orgel*, established in 1886 by the Rotterdam organist Van 't Kruijs. Since 1903, it has been published by the Nederlandse Organisten Vereniging (now the Koninklijke Nederlandse Organisten Vereniging), when it started once again with volume 1. In the second half of the twentieth century, *Het Orgel* has become increasingly high-end; since 1997 it is now published bimonthly, with English summaries, an "organ newsletter," *De Orgelkrant* (eleven times a year), the annual *ZomerAgenda*, and a large website.

Het Orgel has always been a journal for professional organists and serious enthusiasts; but the Netherlands is known for a variety of other organ cultures. Early in the twentieth century, organist Jan Zwart became popular for his psalm improvisations and easy-listening organ music; the "Zwart organ market" demanded another type of journal. Zwart established *Het Orgelistenblad* in 1928; his son Jan II followed his example in the 1950s with *Nederlandse Orgelkunst.* In 1952, *De Praestant* was published; in 1958 *Het Orgelblad* (ed. Feike Asma, pupil of Jan Zwart). All these magazines expired rather soon; their readers are served today by the journal *De Orgelvriend* (1959).

Examples of a denomination-oriented organ culture include the one developed after World War II within the Reformed Church; it stimulated high-quality church music, and was accompanied by "reformed" magazines such as *Eredienst* (1974) and *Organist & Eredienst* (1931; renamed *Muziek & Liturgie* in 2002). The Roman Catholic population has long been served by the *Gregoriusblad* (1876; published by the Nederlandse St. Gregoriusvereniging); more recently, the low-profile *KDOV-blad* of the Katholieke Dirigenten- en Organistenvereniging has gained attention.

On the other hand, some readers felt that *Het Orgel* was not serious enough; they demanded a journal devoted entirely to the tracker organ. Gerard Verloop established *De Mixtuur* (1970–96). The internationally oriented *Organ Yearbook* (1970) is published in the Netherlands by editor Peter Williams. Equally international, but also "born" in the Netherlands, is the International Society of Organ Builders (ISO), founded in Amsterdam (1957). The *ISO Journal* publishes all articles in English, German, and French.

Belgium and Luxembourg

The Dutch journal *Het Orgel* has become popular in Flanders, with its coverage of Flemish organ culture. But Flanders had its own magazines as well; *De Schalmei*, for example, was published bimonthly between 1946 and 1950. Today's journals are: *Orgelkunst* (1978, published by the Vlaamse Vereniging ter Bevordering van de Orgelkunst) and *Het Orgel in Vlaanderen* (2001, published by an association of the same name).

Brussels and French-speaking Belgium had journals like the *Bulletin de la Fédération Belge des Marchands de Pianos, Orgues et Harmoniums* (1923–27). This population currently has *L'Organiste* (1969, published by the Union Wallonne des Organistes). A quite remarkable magazine, *Magazine de l'Orgue* (ed. Jean Ferrard), consists almost entirely of CD reviews. In Luxembourg, the Amis de l'Orgue publish a *Bulletin de liaison* (1991).

Great Britain

Organ journals in English are not always published in English-speaking countries, as is the case with the ISO periodicals published in the Netherlands. Indeed, for a country so invested in its organ culture, Great Britain has a surprisingly limited tradition of organ journals. Church music is well-developed here, and organ music is treated as a significant component of that; organ matters are often discussed in British church music journals. The need for specific organ journals was acknowledged in 1920, when *The Organist and Choirmaster* (1893) was renamed *The Organist*. In 1921, *The Organ: A Quarterly Review for its Makers, its Players and its Lovers* was established.

The British Institute of Organ Studies's (BIOS) main publication is the annual *Journal of the British Institute of Organ Studies* (1977); BIOS also publishes a quarterly newsletter, *BIOS Reporter*, containing news, notes of interest, and research queries. Present-day British journals include the *Bulletin* of the London Society of Organists (1948); the *Quarterly Record* of the Royal Society of Organists (1949); *Organists' Review* (1929), renamed *The Quarterly Record of the Incorporated Association of Organists* (1967); and the annual reports of the College of Organists, started in 1864 as *The College of Organists: Prospectus and Annual Report*, then renamed *The Royal College of Organists: Calendar and Annual Report*. Organbuilders have had their own magazines as well, such as *Incorporated Society of Organ Builders Journal* (1949–72); the Institute of British Organ Building (1995) has published since 2001 a luxurious annual *Journal*.

France

A single issue of *Le moniteur des organists* was published by the Société Internationale des Organistes (1882). Slightly more successful were *Le maître de chappelle: bulletin des organists et de la musique religieuse* (1888), *Le réveil des organists et des maîtres de chapelle* (1893–96), and *L'orgue et les organists* (1924–26). In 1929, the Association des Amis de l'Orgue started publishing the *Bulletin trimestriel des Amis de l'Orgue* (from 1939, *L'Orgue*). With the influential Norbert Dufourcq as its longtime editor, *L'Orgue* remains one of the most important organ journals, a prime source of information on contemporary French (especially Parisian) organ culture. Of special interest is its series *Cahiers et mémoires* (*de l'Orgue*), with issues dedicated to composers like Charles Tournemire and Maurice Duruflé and organists like Pierre Cochereau and Marie-Claire Alain.

Jeunesse et Orgue (1968–88), originally intended for young organists, covered all aspects of international organ culture. *Renaissance de l'Orgue* (1969–70, *Connaissance de l'Orgue* from 1971 on), published by the Association Française pour la Sauvegarde de l'Orgue, has played an important role in the renewed interest in historic organs and historically informed performance practice; its longtime editor Pierre Hardouin was honored with a special issue (no. 100, 1997).

Some journals are devoted to regional organ cultures, builders, and important individuals. The Association Orgues Méridionales published *Orgues méridionales* (1978–96; continued as *Tribunes*, 1997–98). *L'orgue normand* is the journal of the Association Connaissance de l'Orgue (1981–96; revived 1998). *La Flûte Harmonique* (1975, Association Aristide Cavaillé-Coll) and the *Bulletin* of the Association François-Henri Cliquot (1956) focus on individual builders. As for composers, the Association Maurice et Marie-Madeleine Duruflé has been publishing a *Bulletin* since 2001. *Les facteurs d'orgues français* (1980; renamed *Revue des facteurs d'orgues français*) is the journal of the Groupement Professionel des Facteurs d'Orgues. *L'Orgue Francophone* (Fédération Francophone des Amis de l'Orgue, 1986) is not exclusively directed to French readers.

Italy and Spain

Italian organ culture was based primarily on its own traditions until influences from other countries (especially Germany and France, in the late nineteenth century) crossed its borders. One aspect is the relative scarcity of Italian organ journals. Organ-building matters were discussed in foreign magazines or general journals such as *Musica e istrumenti* (1928). Only in the second half of the twentieth century have organ-specific magazines been published: *L'organo: Rivista di cultura organaria e organstica* (1960), *Organista* (1974), and *Informazione Organistica* (1989). In 1994, a luxurious new magazine was established, *Arte Organaria e Organistica*, which has become the leading Italian organ journal. There are also a large number of regional cultural magazines that often cover organ topics.

In Spain, the Asociación Cabanilles de Amigos de Organo published *Organos del pais Valenciano* (1979–82; continued as *Cabanilles*, 1982–90); issues were usually devoted to a particular organ, town, or area. The Associació Catalana de l'Orgue has been publishing *Anuari de l'Orgue* since 2002; the first issue was largely a tribute to builder Gabriel Blancafort.

Scandinavia

Several organ journals in Denmark were published by associations; these included *Meddelelser fra Dansk Organist- og Kantorsamtfund* (1905–34), *Medlemsblad for Dansk Organistforening*, later called *Dansk Kirkemusiker-Tidende* (1907–59), and *Medlemsbladet for dansk Organist- og Kantorsamtfund* (1934–44). The major Danish magazine on organ art today is *Orglet*

(1971), published by the Danske Orgelselskab; it consists of a regular journal and a smaller newsletter.

Organ culture in Sweden experienced a real boost when Hans Davidsson launched the Göteborg Organ Art Center (GOArt) in 1995. The journal that took GOArt activities most seriously, *Orgelforum* (1979, by the Svenska Orgelsällskapet), gave it in turn even greater importance. Edited by Sverker Jullander, the journal has acquired a more professional and modern character, and includes English summaries. Earlier journals concerned with the organ were *Kult och Kunst* (1905–08) and *Kyrko-Musikern* (1939–41); later on, organ-specific magazines were launched, such as *Organum* (1961) and *Orgel* (1962).

Norway is less active in publishing organ periodicals; in 1948, the *Medlemsblad for Norges Organistforbund* was established. In Finland, the Organum-Seuran has been publishing *Organum* since 1964; it now provides English summaries.

Poland and the Czech Republic

In the Bohemian region of the Hapsburg empire of Austria-Hungary, *Caecilie* (1848; renamed *Cecilie*, 1849), a "music journal, mainly for organists, teachers, etc.," was published in what is now the Czech Republic. In the twentieth century, various journals changed names rather frequently: *Mitteilungen des Verbandes der Chorregenten und Organisten in der ČSR* (1928) became *Der Chorbote für die Mitglieder des Kirchenchores* (1929), then simply *Chorbote* (1930–37). *Československý varhaník* (1936) became *Česky varhaník*, then *Varhaník* (1939–43), and after World War II continued again as *Československý varhaník* (1945–50).

Poland has seen a large number of mostly short-lived journals with names like *Kalendarz dla organistów wiejskich* (1890–92, 1910), *Dwutygodnik organistowski* (1893–96), *Związek organistowska* (1911–12), and *Kronika muzyczna organistów diecezji Lubelskiej* (1925–39). The nation's organ journal is *Organy i muzyka organowa* (1977–78; revived 1980).

The Western Hemisphere

South America

The Academia Mexicana de Música Antigua para Órgano has published a journal of same name since 1993, the first in the country. More recently, the heritage of historic organs in Mexico has been the focus of the *Newsletter of the Instituto de Órganos Históricos de Oaxaca, A.C.* since 2001. Brazilian organ culture (which includes historic instruments by Arp SCHNITGER and Aristide CAVAILLÉ-COLL) is the central topic of *Caixa expressive*, published by the Associação Brasiliera de Organistas since 1997.

North America

From 1892 to 1894, Everett E. Truette edited and published *The Organ* (facsimile ed., Boston: Boston Organ Club, 1995). *The Diapason*, "devoted to the organ," has maintained its character as an independent organ newspaper (both in content and format) since its inception in 1909; it is the oldest extant U.S. organ journal and one of the oldest worldwide. *The American Organist* has been the journal of the AMERICAN GUILD OF ORGANISTS since 1918; it claims to be the world's most widely read organ periodical. French organists and practical tips have been one of the areas of interest. *Choir Guide*, later *Choral and Organ Guide* (1948–68) was directed at choir directors and church organists; in later years, it contained almost exclusively reviews.

The Tracker started as the "unofficial newsletter of the unofficial Organ Historical Society" in 1956. It concentrates on the historic organ in America, especially those built in the nineteenth and early twentieth centuries. (Vol. 16, no. 2, however, included an article on "South Viet Nam's Sole Pipe Organ.") *Art of the Organ* was a highly idealistic (and understandably short-lived) journal (1971–72) "for those with a serious interest in the . . . polyphonic organ, both historical and contemporary," primarily mechanical action instruments. *Art of the Organ* did not limit itself to American organ culture.

Westfield (formerly *Early Keyboard Studies Newsletter*, published by the WESTFIELD CENTER since 1984) is devoted to early keyboard instruments and performance practice, including the organ. The *Journal of American Organbuilding* (1986) is published by the American Institute of Organbuilders. *Theatre Organ* (1959) is the journal of the American Association of Theatre Organ Enthusiasts, later the AMERICAN THEATRE ORGAN SOCIETY; the Association also publishes *ATOS International News* and *The Glue Pot*, which provides technical information for pipe organ owners. Journals with a more local character include *Crescendo* (by the Pennsylvania, now Philadelphia, chapter of the AGO; 1938); *The Boston Organ Club Newsletter* (1965); and *The Dieffenbuch* (Tannenberg/Central PA Chapter, OHS; 1976). *The Stentor*, exclusively devoted to one instrument, is published by the Friends of the Wanamaker Organ at Lord and Taylor, Philadelphia (1992).

Various Canadian societies publish their own journals, among them *Mixtures* (1995; Fédération Québécoise des Amis de l'Orgue); *Bulletin de liaison* (1991; Amis de l'Orgue de Montréal); and *Organ Canada/Orgue Canada* (1988; Royal Canadian College of Organists).

The Far East

In Australia, the organ societies of Victoria, Sydney, and New South Wales jointly published *The Australian Organ Quarterly* (1967–68; 1970–71). The Australian College of Organists published a *Yearbook* (1969–74); the Theatre Organ Society of Australia, New South Wales Division published *The Diaphone* (1962–69). The ORGAN HISTORICAL TRUST OF AUSTRALIA publishes *OHTA News* (1977). Other active periodicals include the *Sydney Organ Journal* (1950; Organ Music Society of Sydney); *Organ Voice* (1974; formerly the *Organ Society of Queensland Newsletter*); *Organo pleno* (1962; formerly *Victorian Organ Journal* and the *Society of Organists Newsletter*, published by the Society of Organists, Victoria); and *Plenum* (1977; formerly *The Hunter District Organ Music Society Newsletter*). Plans exist for a new nationwide organ journal.

In New Zealand, the New Zealand Association of Organists is responsible for *NZ Organ News* (1965); the Wellington Organists' Association publishes *The Organ Bench* (1984). In Japan, the Nippon Orugan Kenkyūkai has been publishing *Organ-kenkyū* since 1973.

See also **Organizations**

HANS FIDOM

JAN-PIET KNIJFF

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PESCHEUR (LESPESCHEUR)

Parisian family of organbuilders, active in the seventeenth century. The first family member of note was Pierre Pescheur I (fl. 1544), organist at St. Esprit en-Grève. His relationship to later family members is uncertain. Nicolas Pescheur (b. Paris, ca. 1555; d. there, 1616) was the son of a merchant in St. Germain-des-Prés. He probably studied organ building with Raoul Bourdet, and later with Jan LANGHEDUL in Paris (1585–90). Together with Claude Danyon (Danion) he worked on an organ for Sens Cathedral and built an organ for Chaource in 1596. He settled in Paris in 1600, receiving the appointment of organist at St.-Sulpice, and continued activities in organ building on a lesser scale. He renovated the organs of St. Germain-l'Auserrois (1600–01), St. Etienne-du-Mont (1602), and St. André-des-Arts (1603), and built a new organ for St. Germain-le-Vieil in the Langhedul manner. Later he restored the Paris organ of St. Sauveur, the Augstinian church (1614), St. Benoît (1615), and (probably) St.-Sulpice.

Pierre Pescheur II (b. Paris, ca. 1590; d. there, 1637–40), son of Pierre I, probably trained with his father and then with Paul Maillard. From 1610 to 1612 he worked with Valéran DE HÉMAN (remaining a close friend), built a small organ for Paris, St. Lazare (1617), and worked on organs in St. Victor and St. Leu (1618), St. Germain-l'Auxerrois (1619), and Ste. Geneviève-au-Mont and Ste. Geneviève-des-Ardents (1620). Pescheur built an organ for Amiens Cathedral (1620–24) and in Paris for St. Paul (1623) and St. Gervais (1628; some pipework survives). His most significant instruments were those built for Aubervilliers (ca. 1630) and his last work at St. Etienne-du-Mont (1631–36; the model for most Parisian organs for a half-century). After his death, his workshop was continued by the nephews of De Héman. Together with De Héman, Pescheur founded the classical Parisian school of organ building, with innovations such as the independent Cornet. Pierre Desenclos was his most prominent student. Aubin Pescheur (b. ca. 1595; d. after 1630), son of Nicolas Pescheur, is only known to have worked with Maillard at Rennes in 1628.

DOUGLAS E. BUSH

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PETEGHEM, VAN

Flemish organ-building family. Pieter van Peteghem (b. Wetteren, 24 Jan 1708; d. Ghent, 4 Jun 1787) studied with the Antwerp builder Gilliam Davit, who lodged with the family. After working for Johannes Baptista Forceville (ca. 1660–1739) in Antwerp and Brussels, Pieter established a workshop in Ghent in 1733; by 1740, he was doing business in Scheppingen (Flanders). Pieter concentrated on small instruments with pull-down pedals, including Deinze, Notre Dame (1740); Kemzeke, St.-Jacobus (1747; reb. 1882); Verrebroek, St. Laurentius (1750–52; 1/11; rest. Pels-D'Hondt, 1998); Aalter, St.-Corneliuskerk (1754); and Aalst/Hofstade, Ascension of Our Lady (1762; rest. Pels-D'Hondt, 2002–5).

Pieter van Peteghem created a new type of Flemish organ, with a rich chorus of flute stops and very clear reed stops. He was especially good at building new instruments into preexisting cases. His two-manual instruments, each comprising a Grande Orgue and either a Positiv or Récit, favored French dispositions (Forceville was from Saint-Omer) rather than the Dutch-German stoplists of many Netherlandish builders. Pieter's most significant instrument, built for the Boudelo abbey in Sinaai-Waas (Sint-Niklaas) (1763–64; 3/35; Groot, Positief, Echo), underwent the effects of changing restoration philosophies. The closure of religious institutions in revolutionary France led to its sale to Abraham Meere, who moved it to Vlardingen, Dutch Reformed Cathedral (1822), reduced the number of stops (twenty-seven), and replaced the French Echo division with a Dutch-style Bovenwerk. Plans to install a true Pedal were finally realized by Johan de Koff (1936). A restoration of the organ to its 1822 state retained the Pedal (Vermeulen, 1972–73). With the restoration of the Echo division without the removal of the Bovenwerk (Vermeulen, 1992–93), the Vlaardingen organ is both much larger than the original (4/60) and is once again appropriate for the classical French repertoire it was built for. Pieter built another abbey organ for Affligem (1764–68; closed 1794); it was eventually moved to Binche, Bonne-Espérance Abbey (1865).

After Aegidius (Franciscus) van Peteghem (b. Ghent, 27 Mar 1737; d. 5 Mar 1797) and Lambert (-Benoît) van Peteghem (b. Ghent, 5 Mar 1742; d. 5 Sept 1807), sons of Pieter Peteghem, had joined the Ghent workshop, Pieter extended his business throughout northwestern France, Zeeuws-Vlaanderen, and Brabant (both Dutch and Flemish). Lambert was working with his father by 1767; by 1776, the firm was known by the curious name of L. B. Van Peteghem et Père." Lambert restored the 1656 Destré/Bis organ at Ghent, St. Bavo's Cathedral (1767; choir organ added, Klais, 1935; now 5/91); the firm installed several organs by Pieter, including Kasteel van Voorde (Ninove), St.-Pietersbanden (1769); Lembeke, St. Egidius (1774–80); and Mechelen, Netherlands, Roosendael Abbey (moved to 't Heike, Netherlands, 1803; reb. Vermeulen, 1956, now electro-pneum.). From this point forward, Pieter's activity declined rapidly; he collaborated on organs with his sons, especially Lambert, including Aalst/Herdersem, Notre Dame (1778; rest. Nijs & Zonen, begun 2004); Dendermondse, Brigittinessenklooster (1779; moved to St. Apollonia, 1785–87); and Oekene, St. Martinus (1779–81).

During Pieter's last years, his sons worked separately within the firm. Aegidius installed instruments at Londerzeel, Sint-Amandus (rest. J. Lapon, 2001); Tienen, Broeders Alexianenkapel (with Pieter; 1777; two manuals); and Schelle, St. Petrus- en Paulus (1777–1779); Alden Biesen (1788; 2/19; rest. Wouters-Moors, 1999). Lambert's work forms a transition toward the Rococo organ; he installed instruments at Gyzeghem (1776); Haringe, Sint-Martinus (1778; rest. Draps/Potvlieghe, 1993–94; now 3/29/pull-down); Meerbeke, Sint-Pieters en Sinte-Berlindis (1780); Aspelare, Sint-Amandus (1783); Gavere (Semmerzake), St.-Pieter's Bandenkerk (ca. 1790; rest. Verschueren, 1982); and Ulvenhout, St. Laurentius, 1803.

After Lambert's death, the firm continued under the leadership of Pierre-Charles van Peteghem (1792–1863) and Lambert-Corneille van Peteghem (b. 1779), sons of Lambert. Pierre-Charles is credited with Oud-Heverlee, St. Annakerk (1816; rest. Draps, 2002); Schendelbeke, Sint-Amandus (1833; 1/9; rest. Orgue-Thomas, 2002); Melsen, Sint-Stefanus (1834; rest. Pels-D'Hondt, 1999); Veurne, Seminary, Sint-Jansgasthuis (1838; 1/6; rest. 1973); and Ghent, Notre Dame and St. Peter's (1847–48; 2/31; rest. Pels, 1983). Pierre-Charles and Lambert-Corneille are together given credit for Stavele (1823), but also as Pierre-Charles "en broerer" (Aaigem, 1818) and as "Broers van Peteghem" (Erpe-Mere, Sint-Paulus' Berkering, 1830; rest. Pels and van Leeuwen, 2002–04). Lambert-Corneille built instruments for Leuven, Romaanse Poort (now the Cultureel Centrum, 1828; 1/10; rest. Pels, 1994–96), and Bertem, St. Peter's, 1831.

Sometime in the 1840s, (Cornet) Maximilien van Peteghem (1822–70), son of Pierre-Charles, joined the firm; Lambert-Corneille disappears from the records. Maximilien moved toward the Romantic style in his work. He rebuilt the 1763 François Coppin organ at Geraardsbergen, Muziekacademie (1847), and built an instrument for Bekegem, Sint-Amandus (1852). The renamed "Pierre-Charles van Peteghem en Zoon" built an instrument at Dendermonde, Notre Dame, 1858 (rest. Pels and van Leeuwen, 2002–05). Pierre-Corneille was commissioned to build an organ for Sint-Lievens-Houtem, St. Michaël in 1862; Maximilien probably worked on it with his father and finished it after the latter's death (rest. Potvlieghe-De Maeyer, 1979–83). Thereafter, Maximilien rebuilt the 1681 Le Oyer organ at Hamme, Sint Pieter (1863), and built new instruments for Maarkedal, Notre-Dame La Salette (1864), and Melle, Sint-Martinus (1865). These were the last van Peteghem organs.

The van Peteghem dynasty has the same significance for Belgian organ historians that the van Dams and van Oeckelens have for their Dutch colleagues. Like those families, the work of Pieter and his successors has been the subject of considerable attention in the latter twentieth and early twenty-first centuries. If there is a difference between them, it is the relative lack of controversy greeting restorations of van

Peteghem organs when contrasted with those involving Schnitger and other organs in the Netherlands.

FERDINAND J. DE HEN
RICHARD KASSEL

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PETIT PLEIN JEU

French term for the Organo pleno (PLENUM) of the Positif (Positiv) division. Medium-scaled stops from the lowest pitch through the highest mixture available on a given Positif are included in this registration. Normally, the 8' Montre is doubled by the Bourdon 8'. On a large instrument of the year 1700, the registration would include, on the Positif: Montre 8', Bourdon 8', Prestant 4', Doublette 2', Fourniture, and Cymbale. Composers and theorists of the seventeenth and eighteenth centuries recommended a light, articulate touch for this registration, and numerous PLEIN JEU pieces of the period show a distinct differentiation in texture and rhythmic style between the GRAND PLEIN JEU and the Petit plein jeu.

JESSE E. ESCHBACH

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PFEFFER, JOHN G(EORGE) (1823–1910)

German-born American organbuilder. Johann Georg Pfeffer was born at Stetten bei Heigerloch on 23 April 1823. He was probably trained in Germany. He emigrated to the United States in 1854. After brief stays in New York, Hamilton, Ontario, and Cleveland, he settled in St. Louis in 1859 (identifying himself as an "organmaker" in his first appearance in the St. Louis city directory) and became one of the city's most prominent organbuilders. He lived near the shop of William METZ and may have worked with him, as some features of Pfeffer's early organs resemble those found in the only extant Metz organ. When Metz moved to Collinsville, Illinois, about 1865, Pfeffer worked from Metz's former shop.

Pfeffer was Roman Catholic and built many organs for that denomination. The large organ built in 1865 for "Old" Trinity Lutheran Church in St. Louis, though not his first for that denomination, firmly established his reputation among German Lutherans. The windchest for the Great and Pedal divisions of this instrument were cone-valve chests. The wind was supplied by four cylinder or box-bellows, rather than the more common wedge bellows. Pfeffer also built two organs for the Lutheran Teachers Seminary at Addison, Illinois, which made his name well-known among Lutheran organists. A recently restored instrument stands at Spillville, Iowa, St. Wenceslaus (1876; 1/11; rest. Dobson, 1996).

Two uncommon stops are found in extant Pfeffer organs. One is a 16' Pedal Posaune, with wood resonators, boots, and blocks. The other is a 16' Great Principal in which the lowest notes are attached to the back, sharing a common foot. The two pipes sound together to produce a resultant tone at the 16' pitch.

After Pfeffer's death on 4 Apr 1910, Charles Christian KILGEN (b. 22 Apr 1859; d. 6 May 1932) purchased the Pfeffer company and put his oldest son, Alfred George Kilgen (b. 24 Sept 1886; d. 5 July 1974), in charge, operating it under the Pfeffer name until 1919.

ELIZABETH TOWNE SCHMITT

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PHELPS, LAWRENCE I(RVING) (1923–1999)

American organbuilder, organologist, historian, author, lecturer, acoustician, engineer, and consultant. Born in Somerville, Massachusetts, on 21 May 1923, Phelps's early education was aimed at a musical career. He concentrated on orchestral and choral conducting and organ studies at the New England Conservatory; he also studied electronics at the Massachusetts Radio School, and engineering at Northeastern University. Phelps was apprenticed in 1944 to the organ reformer G. Donald HARRISON at the ÆOLIAN-SKINNER ORGAN COMPANY, from whom he absorbed the traditional skills of organ building. In 1949 he spent a year as voicer and tonal finisher for Walter HOLTKAMP.

Taking from these early proponents of the "American classic" concept, a yearning for a more universal, more versatile organ capable of playing diverse historic styles, Phelps attempted to bring this concept to practical, musical fulfillment. Convinced that the organ was not an end in itself, but merely a means of musical communication, he became motivated by the precept that effectiveness and function were more important than the mere quality of sound. Guided by the instrumental-choral tradition, he applied the same criteria to the organ that had occupied musicians of all instruments and genres. Balance (especially from bass to treble), blend, clarity, and articulation were the hallmarks of all great musical ensembles. Phelps felt that these same qualities should be found in the finest organ design. He was responsible for the design and construction of over four hundred organs, mostly in North America.

Guided by the WERKPRINZIP concepts of the seventeenth- and eighteenth-century German organs, the French classical organs that inspired the Couperins and Nicolas de Grigny, and the best of the modern European examples of organ building, coupled with his engineering insights and skills, Phelps became convinced of the logic and efficiency of certain design principles: key-chambered chest, mechanical key action, divisional independence and completeness, and separate encasement. Many of these features can be seen in his early organs. In 1950, as an independent consultant, Phelps became responsible for the design, installation, and tonal finishing of two organs for Boston, First Church of Christ, Scientist. The larger of these organs is still the largest church organ in the United States. Modifications to the electric and winding systems in this organ led to his article concerning the effects of WINDCHEST design on the speech of organ pipes (*Organ Institute Quarterly*, 1953). This article expressed theories considered radical at the time of its writing, but that are now accepted by leading organbuilders. Phelps lectured on organ design at several universities and AMERICAN GUILD OF ORGANISTS conventions. His articles "Perspective" (*Organ Institute Quarterly*, 1954) and "Short History of the Organ Revival" (*Church Music*, 1967) were the first instances in which concepts of the *Orgelbewegung* (ORGAN REFORM MOVEMENT) were published in English. (Many of Phelps's important papers, including his 1962 lecture "Towards a Rational Tonal Design," are available on his website.)

In 1958 Phelps was appointed tonal director of CASAVANT FRÈRES of St. Hyacinthe, Quebec, where he organized a new department for the manufacture of mechanical action organs in 1960. He was appointed vice president of Casavant in 1967 and president in 1971. Phelps then left to form his own firm, Phelps and Associates, in 1972, in collaboration with Lawrence K. Sinz, whom he appointed vice president. Noteworthy characteristics of Phelps's tracker organs are their light, responsive, totally mechanical key action, accomplished through use of variable ratio squares; superb balance, both between and within the divisions, especially in relation of bass to treble balance; highly articulate, very responsive pipe speech; and the highest mechanical reliability, culminating in consummate contrapuntal clarity. The firm closed in 1981.

Phelps's interest in historic organ building is evident in his work on such instruments as a North German organ at Fort Collins, Colorado State University (rest. Casavant, 1968; thirty-four stops, forty-three ranks); a French classical organ at Fort Collins, St. Luke's Episcopal (1975; thirty stops, forty-four ranks); and the organ in England, Hexham Abbey (1976; thirty-four stops, forty-eight ranks), which encompasses both traditions. The Hexham instrument was the first major pipe organ built in the United States and installed in Europe.

Phelps married the renowned British organist Gillian Weir in 1972. Her performances of music of all periods reinforced his convictions regarding the deep relationship between the organ and its literature. This was shown in the organs that Phelps built subsequently. The organ for Tulsa, Oklahoma, Oral Roberts University (1976; 4/70) is based on the American classic philosophy of stylistic versatility. The totally mechanical action responds with the lightness of a far smaller organ, even with all keyboards coupled.

Phelps was appointed director of custom organs for the Allen Organ Company, Macungie, Pennsylvania, in 1982. He later returned to Boston to supervise the extension of his organ at First Church of Christ, Scientist. He died in that city on 22 February 1999.

ROBERT CAVARRA

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PHYSHARMONIKA

A soft-toned free-reed stop of 16’ or 8’ pitch. Its reeds are mounted within a separate WINDCHEST, sometimes with short resonators. It may be fed from a separate reservoir whose pressure is under the control of a pedal at the console, thus allowing expression. It was introduced to Germany in the mid-nineteenth century by Friedrich LADEGAST, E. F. WALCKER, and other builders. Free reeds without resonators are essentially the same as those used in a harmonium (reed organ). They are not affected by changes in temperature, unlike other pipe forms, making it difficult to keep such stops in tune with the rest of the instrument.
See also **Stop**

EDWARD L. STAUFF

PICCOLO

An open metal or wood manual Flute stop of 2’ (less often 1’) pitch. In its unison form, its smooth and full tone blends well with various flue choruses, but it lacks sufficient bite at upper registers to be truly imitative. A harmonic (double-length) variant is closer to its model, and is usually referred to as an Orchestral Piccolo.
See also **Stop**

PIFFARO

This name has been used for three different stops: (1) a flute stop of 4’ or 2’ pitch, similar to the Orchestral Flute, and sometimes employing double mouths like the Doppelflöte; (2) a synonym for Bifara. (3) a Diapason Celeste, sometimes known as Voce Umana, often found on Italian organs from the sixteenth century onward. This stop is a rare example of a Celeste made from diapason ranks rather than flutes or strings. *Voce Umana* is also a synonym for VOX HUMANA, a reed stop.
See also **Stop**

EDWARD L. STAUFF

PILCHER

American organ-building firm. Henry Pilcher, Sr. (b. Canterbury, England, 27 Jan 1798; d. 1 Nov 1880) apprenticed in London, where his brother, William Pilcher I (ca. 1796–ca. 1868) was an organbuilder in Pimlico (Westminster); he then opened a shop in Dover ca. 1820. In 1832 he arrived in New York, then established himself in Newark, New Jersey. Pilcher moved his workshop often, with stops in New York (1832, 1844–47); Newark (1833–38, 1848–56); New Haven, Connecticut (1838–40); Buckram, New York (1847–48); and Orange, New Jersey (1855–58). In 1850 he employed eight men and produced thirteen organs; one of his largest organs was inaugurated that year at Newark, First Presbyterian.

In 1852, Henry Pilcher, Jr. (1828–1891), and William Pilcher II (1830–1912), sons of Henry Pilcher, Sr., opened a factory in St. Louis as H. and W. Pilcher. When the factory was rebuilt after a fire in 1856, Henry Pilcher, Sr. joined his sons in St. Louis. This plant averaged five organs a year, less than half the 1850 output. Two-thirds of the instruments were one-manual, but Pilcher built three-manual, forty-stop organs for First Presbyterian (1855) and St. Paul Episcopal (1859), both in St. Louis. During the Civil War the sons moved to Chicago while Henry Pilcher, Sr., retired and returned to Newark. The Pilcher Brothers plant was spared in the 1871 Chicago Fire, but remained there for only two more years, when the brothers separated.

William II, after several moves, finally settled in New Orleans, where he and his sons William Henry Pilcher (1854–1910), James Arnold Pilcher (1856–ca. 1911), George Washington Doane Pilcher (1863–1947), Charles Hobart Pilcher (1864–1912), and Albert Snyder Pilcher (1869–1942) built organs. William II patented a bellows (1873) with weights inside the top of the bellows to prevent tampering. His best-known instrument was the three-manual organ for New Orleans, Immaculate Conception, displayed at the Cotton Centennial Exposition (1844).

In 1874, Henry Pilcher, Jr., with his sons Robert Estes Pilcher (1857–1935) and William Edward Pilcher (1859–1968), established H. Pitcher’s Sons in Louisville, Kentucky. Henry Wendover Pilcher (1855–1930), John Vaché Pilcher (1862–1933), and Paul Bartlett Pitcher (1872–1956), sons of Henry Pilcher, Jr., were also active in the firm. This firm had produced some eighteen hundred organs, many still extant, when it was purchased in 1944 by Moller.

ELIZABETH TOWNE SCHMITT

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PIN ACTION

See Action

PIPE

The fundamental sound-producing component of the organ. It is a hollow tube, usually mounted vertically on a WINDCHEST with air supplied to its FOOT, and is usually circular (when made of metal) or rectangular (when made of wood) in cross section. There are two main types of pipe: FLUE (LABIAL) and REED (LINGUAL).

Flue pipes work in a similar way to a recorder, with a thin sheet of air blown across the mouth at the base. The length of the pipe determines the fundamental pitch, and the width relative to the height partly determines the harmonic structure. Narrower pipes have stronger higher harmonics. A pipe that is open at the top will speak almost an octave higher than a STOPPED PIPE that is closed at the top.

Reed pipes use a reed tongue in the boot of the pipe, which beats against a SHALLOT. The pitch is controlled by a tuning wire that alters the length of tongue free to speak. The RESONATOR modifies the harmonic structure of the pipe's sound; a short resonator creates a bright solo sound, such as a Regal, whereas a full-length resonator gives a powerful fundamental for stops such as the Trumpet. Quarter- or half-length resonators are used in some stops to provide brighter chorus reeds, and the latter is often used for bass octaves where space is at a premium.

DISPLAY PIPES in the facade chests are the most visible organ pipes, and are often the longest open pipes (at least in appearance). Often some or all of them are non-speaking (dummy) pipes used for visual effect.
See also **Acoustics; Aluminum; Beard; Copper; Cut-up; Diaphone; Doubled Pipe; Ear; Eight Foot; Four Foot; Free Reeds; Half-Length Stop; Haskell Bass; Nicking; Pipe Metal; Sixteen Foot; Spotted Metal; Stop; Throat; Voicing; Windway; Wood Pipes: Zinc**

ALASTAIR DISLEY

PIPE METAL

Any metal, synthesis, or alloy used in pipe-making; the term is also applied to the tin-lead combination (not a true alloy) called SPOTTED METAL (anywhere from 40 percent to 60 percent tin content) or common metal (closer to 20 percent). The organ's REED and FLUE pipes not made of wood are made of metal (excluding plastic TOY STOPS). Pipes originated as hollowed out reeds; fingerholes would make them into syrinxes and *auloi*, while panpipes, Chinese sheng, and other instruments gathered them into bundles. The Alexandrian CTESIBIUS's apparent invention of pipe-blowing by water-generated WIND PRESSURE and a device to sound individual notes (by mimicking the movement of a finger in relation to a fingerhole on a larger scale) led to the HYDRAULIS (by the third century BCE). By this time, metal FLUE pipes became the norm; certainly bronze (part of the Aquincum organ, third century CE, discovered 1931), lead, copper, and brass were used.

With the return of the organ to the west in the medieval era, the choice of wood for pipes was taken for granted; few writings before the Renaissance even mention metal being used in pipes (except in expenditure records). By the fourteenth century, French pipemakers had begun using spotted metal. The brightness and harmonic richness that tin brought out in the pipe contrasted with the heavier sound of the primarily lead pipe. Yet, while modern pipe-making and studies have tended to focus (some say too much) on the tin-lead combination, other "pure" metals and combinations have been of equal importance to the makers of organ pipes. Lead in a fairly pure form is found extensively in extant sixteenth- and seventeenth-century pipes, and was the standard metal well before then. Modern "pig lead" is smelted to an even greater purity; the resulting softness makes it easier to work, but more brittle and less strong. The addition of a small amount of other metals to the mix (e.g., tin, antimony, copper, and bismuth for up to 2 percent of the total) provides the necessary strength for casting at very high temperatures, hammering, and (when needed) NICKING. The overall tone of a lead pipe is dark and relatively harmonic-free, the sonic movement is agile, and strength of tone grows with increased ranks. Lead pipes are better with smaller scalings and not effective as string or treble stops.

Tin is often used in amounts varying from 95 percent to 100 percent pure. It is strong enough to maintain its shape well, takes a polished finish, and in the proper thickness provides an excellent flue RESONATOR. (The term *resonator*, while usually applied to reed pipes only, is sometimes also used for the upper part of a flue pipe.) Its sound is richly harmonic, and in its thinly hammered state produces the "silver tone" made famous by the SILBERMANN family and the French classical organbuilders. However, some feel that tin has been misused, producing a strident effect in upper registers and an overall colorless quality when cast with walls of too great a thickness. Another limitation: the combination of tin and lead is too soft and heavy for large, long bass pipes (and less effective as such).

ZINC is often used for large pipes (8' and above), where a tin-lead combination would be prohibitively expensive and a "pure" lead pipe is at risk of failing to support its own weight. Zinc pipes are usually painted or lacquered when they will be visible, so that their inevitably mottled appearance does not detract from the others on display. Like "pure lead," a small amount of alloy materials increases its stability. Many builders avoid zinc wherever possible, but for others it is considered a reasonable substitute for a tin-lead combination.

Copper dates back to at least the eleventh century; it faded into disuse until the twentieth century, when the return of tracker action inspired its revived use; Copper is now less often used than tin; it is used primarily in bass pipes and for DISPLAY PIPES, where its coloration (plus the options of flaming and etching) can provide a dramatic contrast with the other "silvery" metals.

ALUMINUM became a commercially viable metal at the turn of the twentieth century; yet only since the 1970s has any serious experimentation been done with it. It polishes up well enough to stand in for tin FACADE pipes. The material seems to be viable for smaller as well as 16' pipes. Higher purity does not risk metal fatigue, since aluminum is both light and strong. Its workability is offset, however, by (1) being limited to pure aluminum in a pipe's construction and (2) the near impossibility of altering the pipe once it is made. Some hear a sound quality that resembles tin-lead in sound more closely than other substitute metals, but this remains a much disputed opinion.

Brass, another ancient pipe material, is used in two ways: as the essential ingredient of the tongues and shallots of reed pipes and, more visibly in display pipes, often as the resonators of brass-imitating EN CHAMADE REEDS. The latter would probably feature flared bells that echo those of orchestral trumpets. It is commonly found in calliopes and band, carousel, and other MECHANICAL ORGANS.

A long-standing controversy surrounds the choice of metal for organ pipes: Does a particular material make an identifiably unique sound? Many builders (and physicists) insist there is little or no influence—that the production of sound is based on the air column, not the metal, and that design and VOICING skill are far more important. Others (mostly experienced builders and performers) claim that the pipe metal used does make a difference; otherwise, why spend money on an expensive material like tin when zinc or aluminum is so much cheaper? One possible consensus is that the workability of the metal and its responsiveness to voicing and other tonal adjustments are what determine the distinctions between materials.

RICHARD KASSEL

PISTON

SEE MECHANICAL AIDS

PITCH AND PITCH STANDARDS

The term *pitch* refers to a benchmark that describes that characteristic of a sound, expressed by combining a note name with a frequency value (e.g., a' = 440Hz) to fix its position in the scale. (*Hz* is an abbreviation for *hertz*, or sound-wave cycle[s] per second [cps].) This allows musicians at any given time or place to ensure uniformity in pitch with one another.

The need for a standard pitch, accepted by players and makers alike, has existed since instruments and voices were first used together (an issue discussed as early in Hercole Bottrigari's *Il Desidero*, 1594–99). These problems arose due to the differing means by which string, brass, and woodwind instruments were (and are) tuned. Prior to the second half of the sixteenth century the organ was the only instrument used in the church, and even when it was used concurrently with voices it was only in an ALTERNATIM fashion, the voices remaining a cappella. Instruments playing in consort at the time were tuned together, but only in relation to each other. (Relics of this practice survive to the present time in the form of transposing orchestral instruments.) When secular instruments such as violins and cornets finally entered the church, a pitch standard had to be agreed upon. But the universal standard now taken for granted was not yet necessary, and differing standards were employed simultaneously throughout the musical world. But, as it turned out, a number of the major standards employed during the last four hundred years or so were remarkably close to the pitch established by the International Standardising Organisation (ISO) in a London meeting, May 1939 (ISO/R 16-1955).

The most important early writings on the subject of pitch were written by Arnolt SCHLICK (1511) and Michael PRAETORIUS (1619). Schlick suggests that an organ suitable for supporting and playing counterpoint for a small choir should have a compass beginning at FF. He determines this note's pipe-length to be 6-1/2 Rhine feet (1 Rhine foot = 12.357"; total ≈ 6-2/3 English feet), resulting in a pitch more than a whole tone (WT) below modern a' (± 377Hz; ≈ modern f♯). He states that "Millenial Church Pitch," so designated to differentiate it from other church pitch standards, originated during about the eleventh century. The Andreas SILBERMANN organ at Strasbourg, Minster (1713–16) was tuned at a' = 392 (modern g'; a "low pitch" used in modern performances of older music); later in the century, Francois BÉDOS DE CELLES gives instructions for this standard (also known as Prague Chor-Thon or Chorton), setting it at a' ≈ 380 (between modern f♯ and g').

The discussions of pitch are as detailed as the technology of the time allowed, especially in the case of Praetorius's *Syntagma Musicum.* He goes to some effort to define his standard by providing a full-scale (lengths) and double-scale (widths) diagram of a complete octave of wood and an octave of metal organ pipes; these are so clear that no room for argument remains. Praetorius notes that "in former times," Church pitch was a WT, even a minor third below the norm in his day, which he considered a' = 424.

A different standard, know as "Cammer-Thon" (Kammerton; a' ≈ 467, modern b♭), emerged as a result of a mixture of instruments playing together. Used in both sacred and secular practice, Kammerton remained fairly constant until its obsolescence. The fact that it was also often referred to as Chorton (but not the "true" Prague Chorton) creates endless confusion, complicated further by Praetorius's habit of using both terms interchangeably when describing any number of different church pitches originating from different countries in former times. Fortunately, the Kammerton and Chorton standards known to Praetorius were transposed during the eighteenth century; Kammerton dropped to -1 ST (semitone; a' ≈ 416, modern g♯); Chorton rose to +1 ST (ISO; a' ≈ 467, modern b♭).

Eighteenth-century Kammerton was known to Kuhnau and Bach as such, and has been in use, within a fraction of a ST, for about three centuries. Some German musicians still consider this Kammerton to be the "true" standard pitch ("medium pitch" in modern early-music performances). Examples of organs pitched at Kammerton survived (albeit perhaps somewhat sharpened) into the early nineteenth century, By the eighteenth century, Chorton could apply to organ standards some two or three STs above Praetorius' Kammerton. Hohe Chorton was encountered in northern Germany, where about one-third of Arp Schnitger's organs and instruments like that at Lübeck, St. Marien, were at a' = 484 (between modern a-♯ and b').

In northern Italy, pitch standards associated with violins, cornets, and the organ were Mezzo Punto and Tutto Punto. Mezzo Punto (Corista do Lombardia, i.e., Lombardian Chorus Tone), in widespread use from around 1580 to the end of the seventeenth century, was more common than Tutto Punto and was about one ST higher. Church choirs of the period and instruments such as the traverse flute and muted cornet generally used Tuono Corista (Chorus Tone), pitched at about one ST lower than Tutto Punto; it was still being used in northern Italy during the eighteenth century. Mezzo Punto was the normal pitch of Venetian church organs until about 1740; when Pietro Nacchini switched to using Tutto Punto, that standard became known as Corista Veneto. In Rome the pitch standards descended from about one ST below ISO pitch in the time of Palestrina to about two STs below by about 1600. Occasionally referred to as Corista di S. Pietro, it prevailed in some Roman organs until the late nineteenth century.

Most large organs built in France prior to 1680 were pitched at a' = 392 (two STs below ISO pitch; modern g'), generally presumed to be the Ton de Chapelle that Mersenne referred to in his reference to a normal pitch pipe; it remained a principal organ standard until the nineteenth century (see Bédos de Celles's Chorton standard above). By the time J. H. Scheibler determined the so-called Paris Conservatory pitch (1834; a' ≈ 440), the trend toward the eventual ISO universal pitch was well on its way.

At the beginning of the seventeenth century the primary English church standard was Quire Pitch, similar to Praetorius's Kammerton. After the nearly complete destruction of organs during the Civil War and Commonwealth, remaining organs and new instruments were initially tuned to their old pitch (up to a' = 473; modern b♭). Gradually the influence of the newer French woodwinds (pitched at Ton de la Chambre) brought about the lowering of English organs to Consort Pitch (a' ≈ 404; between modern g' and g♮) in the eighteenth century. Nineteenth-century English orchestras tuned to a' = 433 (1820s; close to modern a'), later a' = 452 (1850s; between a' and a♯; this was the standard for organs at the International Inventions and Music Exhibition, London, 1885).

Throughout nineteenth-century Europe, pitch standards went through periods of "mean" and "compromise" pitches. Attempts to set an international standard gradually settled at a' = 440, confirmed at the 1939 ISO meeting. The following table summarizes the pitch standards discussed in this entry:

Pitch Standard	Other Names,References	Pitch of a' [8'] (±Hz)	Deviation from ISO Standard in semitones [ST](equivalent note)
German			
Chorton (pre-Praetorius)	Silbermann organ, Strasbourg (1713–16); modern "low pitch"	±392	-2 (g')
Millenial Church Pitch; Prague Chorton	Schlick, 1511; Bédos de Celles, 1766–78	± 377-390	-2.5/-2 (f♯/g')
Church Pitch	Praetorius, 1619	±424	-1 (g♯)
Kammerton/"Chorthon"	Praetorius, 1619	±467	+1 (a♯)
Kammerton (eighteenth century)	Modern "medium pitch"	±416	-1 (g♯)
Chorton (eighteenth century)		±467	+1 (a♯/b')
Hohe Chorton	Schnitger/N. German organs	±484	+2 (b')
Italian			
Corista di S. Pietro		±384	-2.5/-2 (f♯'/g')
Tuono Corista			-1 (g♯')
Tutto Punto	Corista Veneto	440	0 (a')
Mezzo Punto	Corista di Lombardia	±464	+1 (a♯')
French			
Ton de Chapelle		392	-2 (g')
Ton de la Chambre	Ton de la Chambre du Roy	±404	-1.5 (g'/g♯)
Paris, Conservatory	Scheibler, 1834	±441	0 (±a')
British			
Quire Pitch		±473	+1.5 (±a♯/b')
Consort Pitch		±400	-1.5 ((f♯/g')
English Orchestral I	1820s	±439	0 (±a')
English Orchestral II	1850s; 1885 Exhibition	452	+1 ((a♯)
International			
Standard (ISO, 1939)	Scheibler, Stuttgart; Concert	440	0 (a')

Descriptions of pitches and pitch standards set by Schlick, Praetorius, and other theorists received much attention from Alexander J. Ellis (1814–1890), an English expert in ACOUSTICS, who translated Hermann Helmholtz's *On the Sensations of Tone* and offered his own important writings on the subject. His lengthy appendix to *On the Sensations of Tone* includes the translation of those and other pitch standards into frequency numbers; he enhanced his study with frequency calculations of more than three hundred historic TUNING FORKS and research into centuries-old organ pipes using contemporary re-creations.

See also **Tuning and Temperament**

DAVID SMIT

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PITCHFORD AND GARSIDE

Australian organ-building firm. Edwin Nelson Pitchford (1915–1997), born in Bromley, England, joined Henry Willis and Sons as an apprentice in 1929, rising to the position of head tuner in London and maintaining the organs of St. Paul's Cathedral, Alexandra Palace, Royal Albert Hall, and Westminster Cathedral. In 1955 he emigrated to Australia to become the Sydney representative of HILL, NORMAN AND BEARD (AUSTRALIA). He was joined in 1963 by another Englishman, David Stuart Garside (1936–2002), formerly apprenticed to Peter Conacher and Company, Huddersfield (from 1952).

In 1969 Pitchford and Garside separated from Hill, Norman and Beard and established a firm in Sydney, specializing in the restoration of historic organs and tuning and maintenance (over one hundred instruments). Taking a cautious approach to organ conservation (including the retention of cone-tuned pipework, original pitch, voicing characteristics, and console features such as swell lever pedals and flat pedalboards), the firm received fifty major contracts in Sydney during the last three decades of the twentieth century. Organs by prominent British organbuilders (including Bevington and Sons, Brindley and Foster, Conacher, Forster and Andrews, GRAY AND DAVISON, HILL AND SON, T. C. LEWIS and J. W. WALKER) were restored by the firm, in addition to a number of Australian and German organs.

Upon Pitchford's retirement in 1980, Garside continued to work until his sudden death at St. Aloysius' College, Milsons Point, during the reinstallation of the 1989 Létourneau organ from St. Joseph's Basilica, Edmonton, Alberta.

KELVIN HASTIE

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PITMAN CHEST

A WINDCHEST based on the control of individual notes through the STOP CHANNEL. The pitman itself is a small metal piston that, when activated by an imbalance in wind pressure, generates another pressure imbalance that in turn pressures wind into the pipe to be sounded. Perfected by Ernest M. SKINNER in the early twentieth century, it is still in use in the United States.

A product of electro-pneumatic ACTION, pitman stop control is an ingenious if complicated collaboration of windchest, electromagnets, key and stop channels, exhaust valves, pallet, leather pouch, spring, and, of course, the pitman. At rest, a pitman is held down by equalized pressure and gravity. If a stop is put on, a magnet causes the wind pressure in the stop channel (located at the top of the pitman) to be exhausted. The pitman is forced up by the pressure still underneath it, in the KEY CHANNEL; this frees the path from the key channel to the pallet-pouch. However, the WIND PRESSURE inside the overall windchest still equals that of the key channel, and the pallet-pouch remains in the "up" (closed) position, blocking access to the TOE BOARD.

When the key channel's pressure is exhausted by depressing a KEY and setting off another magnet, however, the pallet-pouch (which rests on a spring) is pressed from above by the windchest pressure. The result is that the pallet uncovers the pipe TOE, and the air that has been holding the pallet down now moves up the pipe to sound it. Releasing the key reverses the process, causing the sound to cease.

Within a single stop channel, there is one pitman for each note that can sound a pipe on that channel. Similarly, there are as many pitmans within a pitman chest as there are notes (keys) that can sound a pipe on it. Therefore, if a stop channel is not opened, the pressure below and above the pitman remains equal so that the pitman does not rise; the key channel is still blocked by the pitman at rest (although the main channel is not), and the pressure between key channel and windchest remains equal. The result: the note does not sound, even as another note sounds because its pitman has been raised.

RICHARD KASSEL

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PLAYER PIPE ORGAN

Player pipe organs evolved from earlier automatic musical instruments, incorporating the technology of the MECHANICAL ORGAN, and were the most sophisticated development in that field. These mechanically complex instruments flourished from 1900 to 1930, and were installed mostly in the homes of the wealthy. In addition to capturing the performances of live organists, some builders and roll arrangers used the medium to create a new art form by expanding the possibilities of organ performance beyond what was humanly playable.

Predecessors

Self-contained barrel organs appear to have been the first player organs, with evidence suggesting their existence as early as the tenth century. He describes barrel organs as extremely popular with eighteenth-century aristocracy. The barrels were large cylinders studded with pins, which directly plucked the organ's key action into operation. By the nineteenth century, however, the barrel organ was a portable instrument, the province of street musicians.

By the 1800s, the larger barrel organs had developed into the ORCHESTRION, a cylinder-operated miniature pipe organ. Orchestrions were normally housed in tall, often ornate cabinets; the bellows, cylinder-drive, and mechanism were concealed in the lower case, while the pipework and percussions were displayed through glass above. In the home, such instruments were designed for delicate orchestral effects; in a hotel lobby or restaurant, they were employed to create the illusion of a small band. While some later orchestrions had KEYBOARDS, most could not be played manually, and their ranks were not always full-compass. Southern Germany was the center of orchestrion manufacture; builders included Gebrüder Blessing, Sigmund and Tobias Heizmann, Hupfeld, Imhof and Mukle, and M. Welte und Söhne. By the 1880s and '90s, Welte orchestrions had become popular among upper-class Americans, reflected in the firm's Fifth Avenue showroom in New York. (For information on Welte's American branch, see WELTE ORGAN COMPANY.)

Welte switched over from cylinders to paper rolls in the 1880s. Rolls, developed in the 1870s, were a definite technological breakthrough for the medium. Cylinders were heavy, cumbersome, difficult to manipulate and time-consuming to produce. Rolls were far easier to play and store, and could run at a variety of speeds and assume any practical duration, in contrast to the uniform speed and playing length of the cylinders. By 1900, paper rolls had become the musical recording medium of choice.

Enter the Player Pipe Organ

The player pipe organ, the sophisticated descendant of the orchestrion, ranks among the most complex of musical automata. Like the symphonic organ's tonal style that such automatic mechanisms invariably controlled, the player organ was a highly specialized twentieth-century phenomenon firmly rooted in late-nineteenth-century technology. Although full-scale player pipe organs were created in the 1890s, they were brought to perfection in the twentieth century and are distinctly a creation of the period 1900–1930.

Unlike the majority of automatic instruments, which cannot be played manually, a player pipe organ ordinarily has a keyboard CONSOLE as well as its roll-playing apparatus. Most builders supplied two varieties of rolls: semi-automatic (which play notes only, while stops and expression are controlled manually) and fully automatic (which control every facet of performance). A roll is placed in a spoolbox, run across a tracker bar (whose row of holes corresponds to those in the roll), and received on a take-up spool. The tracker bar conveys pneumatic signals via rubber tubing to an interface, which transmits control impulses to the organ mechanism. The tracker-bar operates either by suction, permitting the spoolbox to be open to atmosphere, or by pressurized air, necessitating a sliding glass panel on the face of the spoolbox to contain the wind.

While rolls are an improvement on cylinders, they possess their own difficulties. Tracking—keeping the roll centered on the tracker bar instead of drifting from side to side—must be precise. If not, it causes roll-reading errors, slipped and cut notes, torn rolls, and music that creeps up and down a semitone (not unlike a severely warped record). Early on, the person "playing" the roll adjusted the tracking, usually by turning an knob that shifted the roll carriage gently left or right. However, builders soon developed automatic tracking systems: placing an "ear" (guide) at each end of the tracker bar to prevent the roll from wandering off course; or adding a continuous chain of perforations in the roll itself that runs in between two holes in the tracker bar. If one hole receives more air, the mechanism senses in which direction the roll is decentered and shifts the roll carriage or tracker bar accordingly.

Roll width is another consideration. Paper expands and contracts with humidity changes, causing a wide roll to shrink and swell itself out of register with the holes in its related tracker bar. Other automatic instruments, including orchestrions and player pianos, have few enough controls that the information can be comfortably contained on a standard-width roll. For example, player pianos require approximately 104 channels (i.e., holes across the roll width), including 88 for the keyboard; their rolls are narrow enough to avoid difficulties from humidity. A semiautomatic player organ is only marginally more complicated than a player piano. Most systems played two manuals' worth of notes, deriving the pedal from the lower registers of one manual. The resulting 120 or so channels fit on a roll of modest width.

However, the simplest fully automatic system requires approximately 165 channels; some systems operate the organ as if they had as many as 400 independent channels. To accommodate so many channels, certain holes in the roll perform more than one function, a pneumatic multiplex system. Some builders chose to use wide rolls, developing methods to overcome the width problems, and therefore had to employ only limited multiplexing. Builders who opted for a narrow roll escaped width difficulties, but then had to multiplex much, if not all, of the information.

The Recording Process

Roll recording was an involved process. Typically, a studio organ was connected to a recording device. The notes, stops, and expression would be recorded as ink or pencil lines on a master roll, which was later perforated. Roll editors then had to augment or reformat the raw information with the necessary coding to drive that builder's player system.

Although each firm touted its roster of recording artists, many rolls were arranged, not hand-played. One method of arrangement was to record the melody or bass line of a piece. This acted as a guide when drawing in the remainder. Some arrangers drew directly on the roll, not bothering to make an actual recording. Other arrangers recorded or drew the rhythmic indications and expression, leaving the notes to be added later.

Whether they originated from a live artist or from the drawing board, master rolls could not be played. Their encoding was used solely to drive the roll-punch that created the actual production rolls. The scale of master rolls was commonly three times that of production rolls: a 3" long perforation on the master roll corresponded to a one-inch hole on the production roll. After the initial editing of the master roll, a production roll was cut for auditioning purposes. Corrections and changes could then be incorporated into the master roll, another production roll punched, and the process repeated until the master roll was acceptable. The master roll would then be used to mass-produce production copies; some roll-punches could create sixteen copies at once.

The Concept of "Recorded" Music

Beyond their mechanical ingenuity, player pipe organs have a deeper significance: they were the highest achievement in self-playing instruments, crowning a centuries-long fascination with automatic music. Yet, with this older technology, recorded music produced live, not recorded, results. The invention of the phonograph just over a century ago forever changed the definition of recording. In that time, a recording has become an electronic reproduction of an encoded performance, heard through loudspeakers rather than from an actual instrument.

An advantage to the player organ when compared with player pianos is that, while the piano roll could not duplicate the note-to-note intensities of live playing, organ rolls operated an electro-pneumatic organ using the same medium as the players did—namely, electricity. Therefore, the recording (and therefore its reproduction) was historically accurate; for organists in the 1920s, a reproducing instrument was the means of choice for preserving their art.

However, the concept of the recording artist is a common thread between older and modern RECORDING TECHNIQUES. Today's musician working with digital editing is not far removed from a musician working with a paper roll to optimize the musical effect. The most successful roll arrangers were often people of musical talent whose imagination outstripped their playing abilities. Because the best playing system had virtually no limitations, a skilled roll arranger could fashion truly symphonic performances, possible only through the medium of a recording playback system.

The Welte Philharmonic

Welte (Freiburg im Breisgau, Germany) was probably the first company to build a fully automatic pipe organ. Having introduced the first reproducing piano in 1904 (the Welte-Mignon), Welte developed a pipe organ recorder (1910) and perfected a reproducing organ mechanism, called the Philharmonic. The fully developed Welte Philharmonic is a two-manual instrument enclosed in a single expression chest with shared tremolo.

It employs a 15-1/4"-wide roll (called the Welte V-VI scale) with 150 channels: a fifty-eight-note accompaniment manual (equivalent to the "Great" in American organs), a fifty-six-note solo manual ("Swell"), a thirty-note Pedal multiplexed from the bottom notes of the Great, four expression channels, two tracking chan-

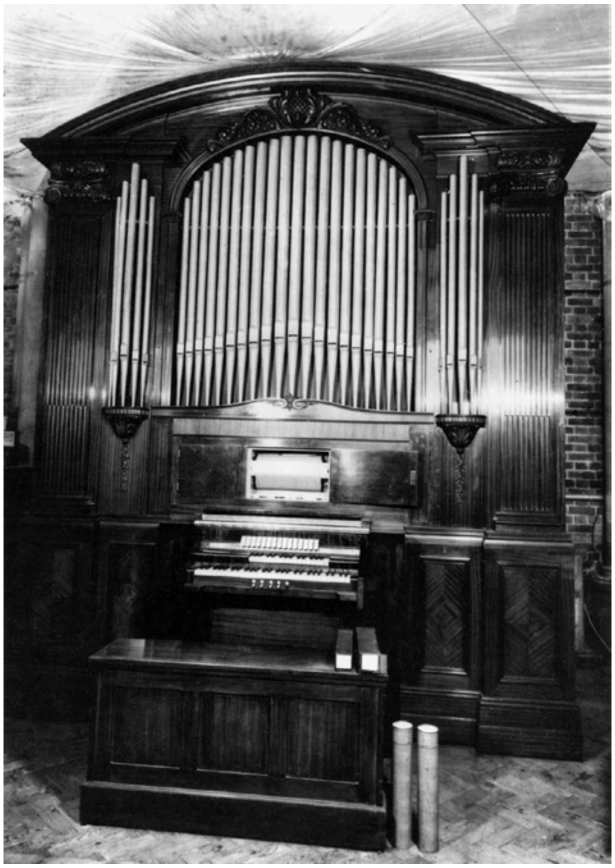

Fig. 61. Welte Philharmonic concert organ, ca. 1920 (10 ranks, 471 pipes) (Photo courtesy Arthur W. J. G. Ord-Hume, The Library of Mechanical Music & Horology).

nels, and twenty-nine controls for stops and devices. The rolls operate on suction. Tracking is achieved by a single chain of perforations that runs between two holes. Welte solved the problem of roll width by using a resilient waxed paper that did not expand sufficiently to alter playing reliability. This paper has proven remarkably durable; many Welte rolls are in much the same condition as when they were first punched. The entire playing system is contained either in the console or in a separate player cabinet.

Like other Welte player mechanisms, the expression control is not keyed to the individual stages of an electro-pneumatic swell engine. Instead, the shades receive signals from timed machinery, in turn governed by four channels: slow open, fast open, slow close, fast close. Registration is controlled through reversibles: one push engages the stop, the next push disengages it. In American organs, an Echo organ was playable via a control that exchanged certain registers of the Swell for those in the Echo. Welte undoubtedly sold hundreds of Philharmonics worldwide, although the majority of instruments in Germany were destroyed in World War II.

American Competitors: Æolian, Skinner

In the United States, the ÆOLIAN COMPANY of New York achieved unquestioned preeminence in the field. By 1915, the firm was associated with three successful musical automata: the Orchestrelle reed organ, the Pianola player piano, and the Duo-Art Reproducing Piano. Æolian's first residence player pipe organ was produced in 1895; it was a FARRAND AND VOTEY organ that Æolian then outfitted to play semi-automatic rolls. Æolian soon established an organ factory in Garwood, New Jersey, and built approximately 890 organs there, virtually all with roll players. This factory ceased production in early 1932, when the Æolian pipe organ division merged with the Skinner Organ Company of Boston to become the ÆOLIAN-SKINNER ORGAN COMPANY.

In 1917, Æolian introduced the fully automatic Duo-Art Organ, a straightforward system with only minor multiplexing. The specification calls for a thirty-stop two-manual organ (each fifty-eight notes, plus a transposing device that added three notes at the top), with separately enclosed Great/Choir and Swell "divisions," a Pedal (derived from both manuals), and an optional Echo playing from the Swell. In moderately sized Æolians, the Duo-Art assigned a separate rank to each item on its stoplist. On larger organs, Duo-Arts were equipped with a "piano, mezzo, forte" control. "Piano" allowed the Duo-Art to draw single stops, while "forte" used the entire instrument by grouping stops of similar tone. Once again, reversibles were used for registration and expression. The 15-1/4"-wide roll contained 176 channels divided into upper and lower holes. Unlike the Welte Philharmonic, Duo-Art controls could be shut off, so that the stops and swells could be worked manually. In the late 1920s, Æolian introduced the Concertola, a kind of "roll changer" in which ten rolls were placed on a miniature Ferris wheel; using a hand-held controller, the listener selected the desired rolls; in a remote location, the Concertola revolved to the requested number, automatically threaded the roll, played it, rewound, and continued to the next selection. The Concertola could provide an automated recital of up to ninety minutes' duration.

Although chiefly a builder of church and concert organs, Ernest M. SKINNER was nonetheless enamored of player organs; his company built no more than seventy-five of them, however, and when his firm merged with Æolian in 1932, Skinner's player system was discontinued, and the new company marketed Æolian's Duo-Art exclusively. In 1915, Skinner patented an intricate system called the Orchestrator. Whereas other systems had three divisions, the Orchestrator played six: Pedal, Great/Choir, and four solo lines. The mechanism proved too complex for successful commercial production, and Skinner redesigned it into the familiar three-voice unit.

Both of Skinner's playing systems relied on pneumatic duplexing, so that all stops were available on both Great and Swell. A 10-1/4"-wide roll (narrowest in the industry) contains 120 channels. The Orchestrator used all 120 channels; the later system needed only 112. From these 112 channels, the Skinner system operated a full two-manual organ with Echo and the capacity to control ninety-three individual stops. Instead of ninety-seven holes for a manual (sixty-one notes and thirty-six stops), the system required only thirty-nine holes for the notes, thanks to three "pilots" that switched between sets of three (overlapping) octaves each. Two pilots could be engaged simultaneously to act as an octave coupler; when all three pilots were engaged, a rapid succession of events led to a nearly instantaneous reregistration of the manual being played. Building on this principle, Skinner was able to control all the notes and stops of a two-manual organ from ninety-three channels. The remaining nineteen channels controlled two four-stage expression boxes, a bass drum and timpani, special Tuba couplers, and a twenty-increment crescendo machine that could increase or decrease dynamic level by step or engage the full organ instantly. The complexity of the Skinner system required a remote relay, containing the pilot switching, the crescendo machine, and the stop jacks.

The Skinner system has one tremendous advantage over reversible stop control. If a reversible misses one perforation, it will work out of sequence for the rest of the roll. If reversibles control stops and expression, as in the Duo-Art, the potential for error is increased. In the Skinner system, each stop and expression change cancels the previous selection and starts afresh. Thus the system is self-correcting, and roll-reading errors from tears or tracking difficulties are minimized.

Austin and Moller

The AUSTIN Organ Company of Hartford, Connecticut, used the widest roll (21-1/6"), containing 235 channels. Their player organ system, the Premier Quadraplex, was first marketed in 1925. The Quadruplex controlled a three-manual organ, with two seven-stage expressions and a crescendo pedal (three channels each). The notes play directly through 215 channels. The thirty-stop specification is multiplexed through the top and bottom octaves of the Choir manual and top octave of the Pedal. Tracking and bar expansion are monitored by perforations instead of tracking ears.

At the time, Austin's recording process was unique. Instead of the conventional master roll, Austin invented a high-speed machine that perforated a roll in real-time directly from the recording organ. The perforator could record at a rate of thirty-one holes per second. When a performance was finished, the roll could be taken from the perforator, placed on a spool, inserted in the spoolbox and heard immediately. There was no difference between master and production rolls; a roll was duplicated by merely playing the recording organ with a finished roll and engaging the perforator. Like many Austin inventions, the Premier Quadraplex was clever in design, simple in construction, and eminently reliable; however, the company only sold sixteen players.

In 1927, M. P. MOLLER, Inc., of Hagerstown, Maryland, developed the last major player organ system, the Moller Artiste Reproducing Player. The rolls are eleven inches wide and contain 133 channels, divided into upper and lower holes. The tracker bar is deceptively simple: two complete sixty-one-note manuals (upper and lower), eight channels controlling two four-stage expressions, and three multiplexing control switches.

The design of the Artiste's multiplexing represents a departure from other players' technology. While a system as heavily multiplexed as Skinner's still had dedicated ranges of channels for Pedal, Swell, and Great, the Artiste treated all divisions as "ancillary." The upper manual was a complete sixty-one-note template; the bottom was divided into three ranges: Bass, Tenor, and Treble. Any division of a four-manual organ could be assigned to any playing range at a number of pitches, by virtue of couplers called "fundamentals." One could therefore hear a standard two-manual, with the bass derived from the Bass and Tenor sections as necessary, or four separate voices, one in each range.

Multiplexing allowed the lower holes to select the fundamental couplers and forty-seven possible stop combinations; another switch converted twenty-nine of them into a twenty-nine-increment crescendo, with independent access to any step. Expression was controlled by continuous perforations on stages of both rows. Like other builders, Moller offered recordings of live organists, but they concentrated on arranged rolls. Only the rhythm was recorded onto the roll, in real time by an arranger using a device called the Nuancer. Final production rolls contained notes only; each roll was then custom-registered for the organ it would play, using a another device called the Symphonizer. Despite Moller's late entry into the market, they sold between 150 and 200 Artistes.

Preserving Performances

Some of Welte's arranged rolls are significant in that they were transcribed from orchestrion rolls, which in turn may have been based on pinned cylinders. The registration and expression would certainly have been reedited to suit the Philharmonic, but the rhythm and overall style tend to suggest salon music practices of the 1870s and 1880s. Along similar lines, some Welte rolls were also derived from the playing of pianists who had recorded for the Welte-Mignon Reproducing Piano.

The Welte has even greater significance for organ historians. The roster of live artists is impressive (Joseph Bonnet, Marcel Dupré, Reginald Goss-Custard, Alfred Hollins, Edwin H. Lemare, Max Reger, Karl Straube) and many are playing their own compositions. And while Welte players have controls for tempo modulation, there is actually only one roll speed, employed throughout the recording process. A well-restored machine running at the proper speed actually reduplicates the tempo, not only crucial for phrasing but essential to Welte's system of timed expression. Thus, the Welte offers many important documents of live performance.

The Æolian Duo-Art was a refined system whose roll catalog centered upon symphonic music. A few famous conductors, including Leopold Stokowski, directed the interpretation of some symphonic rolls; composers, including Camille Saint-Saëns and Edwin H. Lemare, composed pieces specifically for the Duo-Art that were beyond human capability. The Æolian Organ Guild arrangements have much in common with symphonic performance practices of the period: an element of surprise, constant registrational and dynamic accents, a variety of touch, and sparing use of loud stops. The overall characteristic of the arranged rolls takes on a sophisticated, even suave personality.

The majority of Skinner's transcription rolls were arranged by Boston organist Albert W. Snow. One factor in the success of Snow's arrangements was the player's specification. Skinner residence organs could be as small as twelve ranks, yet still contain Trumpet, Oboe, Clarinet, French Horn, Flute ranks, two Celestes, Harp, and Chimes, all duplexed and available on either manual. Snow emphasized woodwinds by combining them in constantly changing ways, lending an orchestral fidelity to his rolls. He was sparing in his use of rhythmic and dynamic accents, relying instead on imaginative registration and solid rhythm for his interpretations.

At the Austin firm, roll arrangements and editing were carried out by Harry W. Austin, a brother of the company's founder-directors. Only one Austin Quadruplex player remains in its original installation, the Aetna Life and Casualty building in Hartford, Connecticut. The Austin catalog is best known for its live recordings, especially a series that Lynnwood Farnam recorded shortly before his death in 1930. The Quadruplex is an uncannily precise player, and the performances reflect this.

In the art of arranged rolls, however, no system makes music quite like the Moller Artiste. Organist and conductor Frederick Albert Hoschke (1876–1936) was Moller's roll arranger, working with the firm from 1927 to 1934. While his actual instrumental abilities are unknown, Hoschke's roll arrangements testify to an exciting musical talent. His work combines rhythmic ingenuity, registrational variety, a highly developed sense of accent, and a genuine interpretational originality. Among his finest rolls are Pyotr Ilich Tchaikovsky's "Waltz of the Flowers" from *The Nutcracker* (conceived as a Viennese-style waltz) and *Overture: 1812*; the "Bacchanal" from Saint-Saëns's *Samson and Delilah*; Johann Strauss's *On the Beautiful Blue Danube*; and Ambroise Thomas's overture to *Mignon*.

Nearly every organbuilder offered a player of some kind; in addition to the five firms already discussed, ESTEY, W. W. KIMBALL, WURLITZER, and other companies made proprietary roll systems. Some firms marketed nothing but automatic players for use by builders who did not have a player system. Other builders equipped standard eighty-eight-note piano players to organs, which would operate from supply house rolls. The above descriptions are indicative of the lengths to which the industry went to produce recorded music, and are merely examples of the most popular or unusual mechanisms.

JONATHAN AMBROSINO

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PLEIN JEU

(1) Mixture stop of French eighteenth-, nineteenth-, and twentieth-century organs. The Plein Jeu owes its origin to early-eighteenth-century builders who abandoned the traditional Fourniture and Cymbale (CYMBAL) dichotomy soon after Cymbale registrations became obsolete. At this time, builders began merging the Fourniture and Cymbale stops together on one drawstop, first on the Positif (POSITIV) and later on the Grand Orgue. The Plein Jeu VII on the Positif division of the François-Henri CLIQUOT organ at Poitiers (1790) illustrates this approach to mixture composition. (For specifications of this organ, see FRANCE.)

In the nineteenth century, the practice of uniting the two classical mixture stops on one drawstop proliferated. Clement, writing a report on Aristide CAVAILLÉ-COLL's instrument at Ajaccio in 1849, objected,

> The Fourniture and Cymbale are united on the same slider. We see a serious inconvenience in not maintaining the separation of these two stops so essential in the make-up of the Plein Jeu. If, later, one of these stops was in poor condition, one would be obliged to give up both of them since they have been made inseparable. This new offense committed against the Plein Jeu is a clue to the inclinations of the majority of organbuilders of our time who sacrifice the real organ to "jeux de fantasie" which are more proper to the performance of a solo rather than a true piece of religious music.

Although many instruments of Cavaillé-Coll, often with pipework extant from earlier periods, maintained the ancient Fourniture-Cymbale separation, more often than not a Plein Jeu appellation was employed by the builder when only one mixture is specified on a given division. In the majority of instances, Cavaillé-Coll supplied only octaves and fifths in his Plein Jeu dispositions.

Frequently, in the instruments Cavaillé-Coll constructed between 1858 and 1880, the Plein Jeu was composed without breaks and accumulated ranks as one progressed toward the treble. This style of mixture, brought to France by Joseph MERKLIN, was dubbed Plein Jeu Harmonique. Examples are found in St.-Sulpice, Paris, 1862 (Positif Plein Jeu Harmonique III-VI) as well as Notre-Dame, Paris (Positif Plein-Jeu Harmonique III-VI; Fourniture II-V and Cymbale II-V on the Grand Orgue). After 1880, Cavaillé-Coll returned to classically composed Plein Jeu stops. Although direct evidence providing Alexandre Guilmant's influence on Cavaillé-Coll in this matter is lacking, it is known that Guilmant found the Plein Jeu Harmonique less than ideal:

> We now construct some Plein Jeu stops composed of three ranks in the bass progressing up to six ranks in the treble. This composition has the serious drawback of not giving enough clarity to the bass and having too low harmonics in the treble (16′ and even 32′ harmonics). I don't believe this composition is good, for in the performance of fugues and polyphonic pieces, it gives no distinction to the entry of the inner parts, and it seems to me indispensable to return to the old compositions which, for mixtures, were excellent.

(2) French plenum registration of the seventeenth and eighteenth centuries.

See also **Grand Plein Jeu; Petit Plein Jeu**

JESSE E. ESCHBACH

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PLENUM

(Lat. "organum plenum," full organ.) A registrational term commonly used in Germany and the Netherlands during the seventeenth and eighteenth centuries. Synonymous phrases include (Ger.) *das volle Werk*, *die volle Orgel*; (Lat.) *organo pleno*; (Fr.) *(grand) plein jeu*; and (It.) *per l'Organo pieno*. Although its name may suggest the indiscriminate use of all stops simultaneously, *organum plenum* designates a carefully selected PRINCIPAL ensemble, its REGISTRATION often consisting of principals, MIXTURES, and supporting flue registers in the manuals, and principals, mixtures, supporting flue registers, and reeds in the PEDAL. While its precise makeup changed somewhat from decade to decade and from locality to locality, the term remained a central concept of German and northern European organ building and organ music throughout the Baroque period.

The Plenum Registration

It seems most likely that the plenum ensemble grew out of the medieval BLOCKWERK (Dutch *Blokwerk*), an organ consisting solely of several Principal RANKS (running in length from 16' or 8' to high-pitched, mixturelike pipes) that were permanently "on." Since the ranks could not be drawn separately, the Principal CHORUS was the only sound the Blockwerk could produce. With the expansion of the organ and the introduction of individual DRAWSTOPS, new and more variegated registrations became possible. This contrast between the plenum and the smaller, more colorful combinations was noted by the Baroque theorist Mattheson in 1739: "In general, organ registrations can be divided into two families. To the first belongs the full organ. To the second belong all the remaining diverse variations, which can be realized especially through the use of several manuals and weaker but nevertheless carefully selected stops."

The plenum registration of the early Baroque was modest in size. To Michael PRAETORIUS (1619), it meant no more than the Principal and the Mixture, a combination he called "das volle Werk." In his view, the higher-pitched Principal stops (Octave, Quint, and Superoctave) were unnecessary, as they were already included in the Mixture. On the main organ of Amsterdam, Oude Kerk (Niehoff, Suisse, van Coelen, 1539–42; reb. 1545, 1567; used regularly by Jan Pieterszoon Sweelinck), the HAUPTWERK consisted of only four stops: Principal 16', Octave 8', Mixture, and Scharf. Taken together, these registers would appear to constitute the plenum described by Praetorius. Reed and flute stops on the Oude Kerk organ were found only in the other manual divisions, the OBERWERK and RÜCKPOSITIV, and in the Pedal.

By the late seventeenth century, more Principal stops were added to the plenum ensemble, and full-length reeds included among the pedal registers. Andreas WERCKMEISTER warned against using more than one stop of each pitch in each division; otherwise, the disparate nature of the registers would ruin the ensemble, and the winding would be sorely taxed. Following Werckmeister's advice, on the 1636 Gottfried FRITZSCHE organ at Hamburg, Jakobkirche, rebuilt by Arp SCHNITGER, 1689–93 (played by Bach and Handel, among others), a large plenum based on 16' manual pitch would have consisted of: Hauptwerk: Principal 16', Octav 8', Octav 4', Superoctav 2', Mixtur VII-IX, Rauschpfeife II; + Pedal: Principal 32', Octav 16', Octav 8', Octav 4', Mixtur, VI-VIII, Rauschpfeife III, Posaune 32', Posaune 16', Trompete 8', Trompete 4'. The Principal chorus of the Rückpositiv (Principal 8', Octav 4', Octav 2', Scharf VI-VIII) or the Oberwerk (Principal 8', Octav 4', Octav 2', Scharf IV-VI, Cimbel III) might have been added to the Hauptwerk, via a SHOVE coupler (although it has been shown that, on most German and Dutch instruments, it is unlikely that more than one additional manual was coupled into the Hauptwerk). For a plenum based on 8' manual pitch, the Hauptwerk Principal 16' and Pedal Principal 32' and Posaune 32' would have been removed.

Despite Werckmeister's admonition, by 1700 or so organists were adding doubling 16', 8', and 4' flute stops to the plenum ensemble when winding allowed, somewhat in the fashion of the French PLEIN JEU. For instance, Gottfried SILBERMANN recommended the following for a "pure-sounding plenum" ("ein reines, volles Spiel") in conjunction with an instrument built for Fraureuth (1742; 2/20): Manual: Principal 8', Rohrflöte 8', Octava 4', Spitzflöte 4', Quinta 2 2/3', Octava 2', Mixtur; + Oberwerk: Gedackt 8', Rohrflöte 4', Octava 2', Quinta 1-1/3', Sifflöte 1', Cimbel; + Pedal: Sub-Bass 16', Posaunen-Bass 16'.

As Silbermann was making his recommendations, others were proposing a much broader plenum, encompassing almost any flue stop that would add weight or brilliance to the Principal ensemble. Mattheson, writing in 1739, was willing to expand a Schnitger- or Silbermann-type plenum with Sorduns, Salicionals, Quints/Quintades, Nasats, Terzians, and Sesquialteras in manuals or pedal; the Posaune could be added to the Pedal, but not in the manual, for, he noted, "Posaunes are reed pipes that are excluded . . . because the Posaune rattles too much on account of its pitch." Jacob ADLUNG, writing in the first half of the eighteenth century, described a similarly expansive manual plenum: "One must have registers that brighten. . . . If one does not wish such a strong combination, then one should leave . . . whatever one wishes [out]." He added, "One must also have stops, however, which add gravity": Quintatons, Gedackts, Rohrflötes, Bourdons of 16' or 8' length, the Gemshorn 8', and others. For the Pedal division, Adlung noted that it needed to be strong "in order to be heard against the manual." Greater gravity meant using the Contrabass 32', Subbass 16', Gedackt 8', Principal 32' and 16', Violon 16', and the Octave 8', when the organ had enough wind (especially when the Pedal had its own bellows). Brighter Pedal voices might include the Octaves 4' and 2' and even Mixtures; lacking these, couplings from Pedal to manual registers might work as well. Depending on the situation, the Posaunes 32' and 16', Trumpet, and other reeds could be included in the plenum as well.

The use of numerous doubling stops and the inclusion of mixtures containing third-sounding ranks (e.g., Terzian and Sesquialtera) marked a sharp departure from late seventeenth-century North-German and Dutch plenum practice. It is interesting to note, however, that the organs of THURINGIA, on which Johann Sebastian Bach played most of his organ works, commonly contained a wide range of 8' and 4' stops in each division and chorus mixtures with third-sounding ranks. The more encompassing plenum described by

Mattheson and Adlung may be more appropriate for the majority of Bach's organ compositions than the "purer" late seventeenth-century plenum associated with Schnitger's instruments.

During the second half of the eighteenth century, still more registers were added to the plenum, including manual reeds (by, among others, F. W. Marpurg, 1757, or J. H. Knecht, 1796). The trend toward a thicker, weightier plenum continued in the nineteenth century, reaching a climax in the instruments of Wilhelm SAUER and the music of Max Reger, for which the indication "full organ" meant just that: of practically every stop.

The Plenum Repertory

In Germany and the Netherlands, the plenum registration was long associated with the playing of "free" pieces: preludes, fantasias, toccatas, fugues, passacaglias, ciacconas, and other works not bound to a chorale melody. In the Baroque period, such pieces were performed during the "free preluding" that commonly took place at the beginning and end of Protestant church services, at climactic moments in Catholic worship services, and at the opening and close of organ demonstrations and organ recitals. For example, Kortkamp gave an account of a 1655 recital by his teacher Matthias Weckmann at the Jacobikirche in Hamburg, noting that Weckmann began by fantasizing "on the full organ" and concluded by playing a fugue, again "on the full organ." In between, he improvised on the chorale *An Wasserflüssen Babylon*, using a smaller combination on the Hauptwerk, Rückpositiv, and Pedal divisions. This parallels exactly Bach's procedure for testing or demonstrating an organ, as described by Forkel in his 1802 biography; Bach would begin with a prelude and fugue "with the full organ." He then showed his "art of using the stops" for a trio, a quartet, etc., and an organ chorale. He concluded with another fugue "with the full organ."

Among theorists, Niedt (1706) instructed neophytes to improvise free pieces "with the full organ, or something just about as strong"; while Scheibe (1739) advised church organists that free improvisation (i. e., without chorale) "should employ good and lively invention and should crown such a prelude or postlude with a fine and magnificent fugue," all "with the full organ.'

Manuscripts of many Bach plenum are marked "pro Organo pleno," including the Prelude and Fugue in B Minor (BWV 544), the Passacaglia in C Minor (BWV 582), and the Allabreve in D Major (BWV 589). Certain kinds of chorale preludes written in the manner of free pieces were also performed with a plenum registration: chorale fugues, fantasias, preludes with a tutti instrumental texture, and preludes written in imitation of Renaissance vocal style (*stile antico*). Examples can be found in Bach's *Clavierübung* III.

Plenum registration was associated with the use of the main manual (usually the Hauptwerk) and pedal. While registers from another division could be coupled into the Hauptwerk to bolster the Principal ensemble (see above), the playing usually took place entirely on the Hauptwerk manual. On occasion, a second manual was used for echo effects, a popular Baroque device from Sweelinck's "echo fantasias" to Bach's "St. Anne" Prelude in E♭ Major (BWV 552/1). In his "Dorian" Toccata in D Minor (BWV 538/1) and some concerto arrangements, Bach even requested the use of two manuals (and switched between them) within a plenum context. But these pieces were exceptional; in unmarked free works, contrasts were to be provided by thickening and thinning textures rather than by wholesale change of manual.

The plenum of Germany and the Netherlands was emblematic of an international phenomenon during the Baroque period. Similar Principal chorus registrations were found elsewhere: the GRAND PLEIN JEU of France, used for noble, fully textured pieces; the full organ of England, used for full-organ voluntaries; the RIPIENO or *organo pieno* of Italy, used for intonaziones, preludes, and toccatas (except those played during the Elevation of the Host); and the *lleno* or *plé* of Spain and Portugal, used for the *tiento*.

GEORGE B. STAUFFER

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PNEUMATIC ACTION

See Action

PNEUMATIC BALANCERS

See Action

POGSON, ROGER H(ERBERT) (B. 1932)

Australian organbuilder. Born in Sydney on 25 July 1932, Pogson established a business in 1963, after working for Sydney T. Noad and Son. While he built seven small electric-action organs in the period 1964–70, he was influenced by the emerging Australian Organ Reform Movement and constructed his first mechanical action organ in 1968 (Parramatta, New South Wales, King's School). This led to several major contracts for Australian university and conservatory halls around Australia, with one smaller church instrument exported to Japan in 1984. His largest instrument was built for the University of Queensland, Mayne Hall (1976; 3/45).

Pogson's work is notable for its extensive use of natural timber, engineering finesse, and excellent workmanship. He has managed workshops in Sydney, and from 1982 on, in Orange, New South Wales. Since 1972 he has restored a number of historic organs using traditional materials and techniques; his greatest achievement in this area was the restoration of the 1890 Hill organ in Sydney Town Hall, a ten-year project that was completed in 1982 to world acclaim. In recognition of his contribution to Australian organ building, Pogson was made an honorary life member of the Organ Historical Trust of Australia in 1992. He has also built harpsichords and restored string instruments.

Kelvin Hastie

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POLAND

The beginnings of organ building and organ playing in Poland are linked with the adoption of Western Christianity (966). The first evidence of Polish activity is the Cistercian abbey at Trzebnica, where in the year 1218 instructions for organ playing are mentioned, and the Dominican monastery at Sandomierz, where the organist died at the hands of the Tartars in 1260. A little later, organs appear in principal towns and ecclesiastical centers (Plock, ca. 1350; Wielun and Torun, both 1343; and Cracow, Corpus Christi, 1373).

The first builder known by name is Jan Wanc of Zywiec, who in 1381 constructed an organ with a pedalboard (rare in Europe at the time) at Kety, near Cracow. Historical reports on the organ building in the fifteenth century have survived. Chelmza Cathedral obtained an organ in 1408; a new organ was built at Kalisz (1403–11). The installation of an organ in the parish church at Buk near Poznan by Stanislaw Bródka in 1439 indicates that the organ spread to the countryside. Instruments were later reported at Wolbrom (1460) and Wloclawek (1483). By the end of the century builders Jan Niedziela and Stefan of Przemysl were known in the Cracow region.

From this time on, there are signs of an exchange between regions and countries. Laurentius of Nürnberg was active in Poznan; Petrus Handlar de Kyczng (i.e., from the Franconian town of Kietzing) is recorded in Cracow in 1495. The standing of Polish organ craftsmanship must have been quite high, since Polish builders sometimes installed organs in Germany, considered the center of the trade at that time. The most sought-after master was undoubtedly the Dominican Mikolaj "Schalentzki" (a distorted surname), who from 1499 to 1507 built a series of instruments in Bautzen, Freiberg, Görlitz, and Zwickau.

Although organs were common even in countryside churches already by the sixteenth century, most village churches had portable chest-organs or regals rather than larger positives. Congregational singing was not a part of Catholic liturgy of that time; hence, small instruments were used for intonation and accompaniment when only a few cantors or boy choristers were involved. This denominational feature explains the typical seventeenth century tendency toward having more than one instrument in some larger churches, each serving a different altar or chapel. Large organs were not in daily use but were reserved for feasts and holidays.

Although, as in other countries, the main centers for Polish organ building were cities such as Gdansk, Cracow, Luck, Lwów, Plock, Poznan, Przemysl, and Torun, the geographical dispersion seems to testify to a widespread, territorially unbounded urge to equip at least the more prominent churches with an organ. Even with the limited data available, it is possible to see stylistic connections or trends of influence already forming along the lines of, say, Poznan–Gniezno–Toruñ–Wloclawek; Cracow–Przemysl–Lwów; Cracow–Kielce–Sandomierz–Lublin; and, to a lesser degree, Cracow–Poznan and Cracow–Wroclaw (Breslau). The number of places mentioned above is a pale reflection of the actual state of affairs, especially in the sixteenth century, when several dozen organbuilders were active at any one time; there was especially significant activity in eastern Poland. One of the most important builders of the first half of the sixteenth century, Stanislaw Warpaski, built cathedral organs at Gniezno, Cracow, Sandomierz, and Wloclawek. Other builders active in Cracow included Stanislaw Komorowski and Andrzej of Olkusz. In Plock there was Jan Coravia; Jan Wyszenski worked in Luck.

Atmospheric conditions were the apparent cause for the widespread use of metal drawstops, rods, and trundles instead of wooden stop-knobs and other parts of the stop mechanism generally used in the West. Sliders are hard to operate in damp or freezing temperatures. The pedalboard, a standard feature of all larger Polish organs from the turn of the fifteenth century, was of the so-called German type (i.e., with long and wide keys hinged under the bench with metal springs). As can be judged from extant documents and early sixteenth-century music, its compass was initially from G. There is no evidence for the French or Italian types. The history of the southern Polish organ is close to those in the Hapsburg lands; even instruments in central and northeastern provinces reveal similar characteristics. In the north, closer to the Baltic Sea, northern European characteristics were manifest more in outward appearance than in construction; Brustwerks were rare, for example.

By the seventeenth century, the organ was a significant presence in Polish houses of worship, especially in urban cathedrals and churches, but also in monasteries and abbeys (excepting those that did not use music), collegiate churches, the diaconal churches, and many rural parish churches. There were also numerous positives, built for domestic music-making. This was an intense period of organ building throughout Poland, especially in the first half of the seventeenth century. Reduced considerably during the Swedish and Cossack wars in mid-century, a renewal led to an era of large endowments for ecclesiastical buildings by 1700. Major organbuilders of this century included Mateusz Brandtner, Jan GLOWINSKI (Lezajsk, 1680–1693), Jan Helwig of Neustadt (Schleswig-Holstein), Jan Hummel, the Kuntz brothers of Regensburg, Szymon Liliusz, the Nitrowski family, and Piotr Ostrowski. Many of these builders were known outside of Poland. Notable organs were built at Toruñ, Blessed Virgin Mary (1611); Olkusz (1612–17); Kazimierz Dolny (1607–20); Frombork (1693); and Sandomierz (1698).

The eighteenth century, at least up to the time of the Partitions (1772–1795, when Poland ceased to be a political entity), continued the pattern of the latter half of the preceding century, despite the Northern War (1700–1721). Constructional principles behind Polish instruments were for the most part unchanged; only the external design of instruments along with artistic trends. Many large instruments were constructed, surpassing in design and dimensions anything previously built; from this time comes the splendidly preserved organ in the Cistercian monastery at Jedrzejów; of the later and considerably larger organ at Oliwa, there now remains only the facade to give an idea of the magnitude and complexity of the original. Smaller organs were installed in the Jesuit churches at Polock and Swieta Lipka, the Pauline church at Czestochowa, the Cistercian church at Lad, the Bernardine churches in Kalwaria Zebrzydowska, Poznan, and Warsaw, and at Ostroleka, Mstów, and St. Anne in Cracow, among many others. Master builders of the pre-Partitions era include Antoni of Glogów, the CASPARINI family of Silesia, Wawrzyniec Harbutowski, Jan Janiczek, Mikolaj Janson, Wojciech Libowicz, Andrzej Majeronowicz, Szymon Sadkowski, Jakub Stankiewicz, and Jan Wulf. While in previous centuries the main centers of the craft were concentrated in western Poland, vigorous activity had now begun in and around Lwów, Warsaw, and Wilno, as well as in Cistercian and Bernardine monastic workshops. Jerzy Wójcik and Daniel Wróblewski, both active in Scandinavian countries, represented Polish organ-building craft abroad.

Use of equal temperament and extending the scale compass to the lower chromatic notes had begun in the second quarter of the eighteenth century. These organs used a keyboard of four full chromatic octaves, instead of a keyboard with three full octaves and a short octave in the bass. Extension of pedal compasses also occurred. However, the short octave persisted well into the nineteenth century. Larger organs were equipped with devices such as an extra, transposing keyboard attached to a three-manual 1745 Józef SITARSKI organ

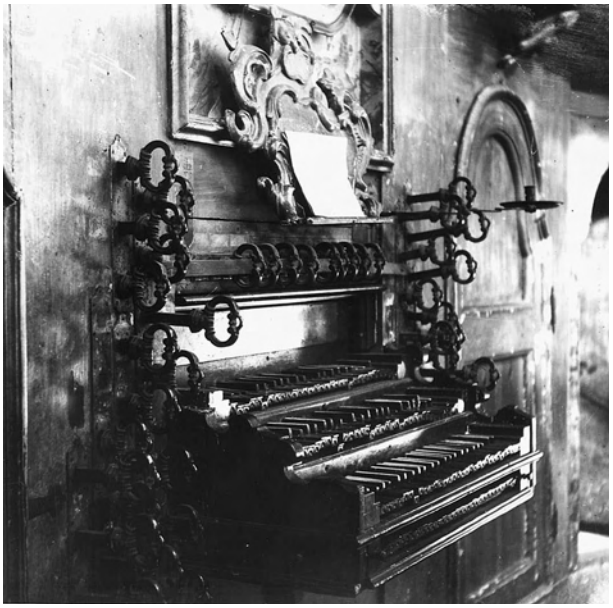

Fig. 62. Console of the Jedrzejów organ (Józef Sitarski, 1745; note the retractable transposing keyboard beneath the Choir manual).

in Jedrzejów. It is housed under the console and, when pulled out, engages the keys of the choir organ.

The change from Baroque vocal/instrumental style, with its requirement of an accompanying keyboard instrument to ensure a harmonic foundation or basso continuo, to an independent symphony orchestra and the more homophonic classical style, did not at first change much in Polish organ design. (Indeed, organs with the traditional layout of main organ and separate chair organ were still being built until ca. 1750.) Many builders showed a peculiar conservatism, either because they were convinced of the validity of the old ideals, or because of inability to adapt to changing circumstances. Others, especially in the first half of the nineteenth century, adopted the innovations only in part, retaining many of the older concepts. However, by the second half of the nineteenth century, the new ideas had gained a complete victory, at considerable cost to historic instruments, which were generally altered; thus the last pre-Baroque instruments vanished. In spite of Poland's considerable economic and political difficulties, there were a large number of organ-building workshops in the nineteenth century. Among them were urban builders Fryderyk Buchholtz, Jan Ciezartowicz, Rafal Ostrowski, Karol Zakiewicz, and Ignacy Ziernicki (still using Baroque organ design), as well as several provincial masters: Jan Dlugi of Nowy Targ, Jan Hawel of Pyskowice, Konstanty Kaminski of Opalenica, and Tytman and Mackiewicz in Wilno. Major rebuildings were undertaken: Cracow, St. Mary's (Ziernicki, 1800), Chelm Cathedral (Buchholtz), Plock Cathedral (Ciezartowicz, 1822), and Warsaw Cathedral (Wilhelm Bredow, 1841). New trends in organ building surfaced about mid-century in the instruments of Roman Duchenski, Tomasz Fall, Mateusz Mielczarski, Antoni Sapalski, Ignacy and Tomasz Wojciechowski, and Karol Zakiewicz. Hugon Ernest Biernacki was one of the first to introduce mass production to organ making; his approach was taken up by Leopold Blomberg (successor to Mielczarski); Henryk Hartman; Jan SLIWINSKI, a pupil of Aristide CAVAILLÉ-COLL; Józef Szymanski; and the Zebrowski family. Foreign builders working in Poland include the Saxon Bredow; Carl Hesse and Franz Ulman of Austria; Karol Kuttler and Wenzel Thiel of Opawa; Friedrich LADEGAST of Ludwigsburg; Moritz Müller of Breslau; Otto RIEGER in Silesia, and the Walther brothers. Although Polish organ building shared general characteristics with other Central and East European countries, it had its own special qualities: (1) The Fujara (Fugara), usually associated with seventeenth-century Silesia (Javor, 1663; Bohemia), is recorded from 1660 on. (2) The Salicional (Salicet), cited as first appearing in Europe in 1632, was used in Poland as early as 1611 (Toruñ, Blessed Virgin Mary). Narrow-scale stops like Salicionals and the Gambas were long favored not only as attractive timbres, but as substitutes for reeds, never as widespread in Poland as in France and Iberia. This may have been due to the aforementioned climate with its extreme temperature and sudden weather changes, making the tuning of reed stops difficult. The Polish Zimbelstern, producing a brassy clash in the uppermost register and used in combination with other stops, might also be a reed substitute. (3) The Polish use of low-tin pipe metal, if not pure lead stops in many old organs, might not have been a simple matter of economy but a remedy for the so-called tin disease or crystallization of that metal at low temperatures. (4) The acoustic Timbals (Timpani), a stop found mostly in large organs elsewhere, was (and still is) present even in little country organs in Poland. The local Roman Catholic Church ritual called for its use (alone or with the Zimbelstern) in the Mass and Office. Be it a cause or effect, the average Polish congregant, even as late as about 1900, thought little of an instrument that could not produce a deep Subcontra rumble during the Elevation or at other points of the Mass or Vespers. (5) Polish organs included rectangular metal flue-pipes, practically unknown in the rest of Europe. (6) Finally, absent a thorough investigation, we may only postulate that the box-bellows made its first known appearance to be in southeastern Poland (Krosno, 1614). MARCUSSEN & SON's claim to its invention seems, in any case, untenable.

Twentieth-century development in the interwar period (1918–1939) began with Poland as self-sufficient in organ manufacturing. Larger shops that survived the economic crisis produced enough instruments to satisfy local needs and successfully competed with foreign companies (Caecilia of Austria, Rieger, Wilhelm SAUER). Their organs were comparable to the average central European factory-made product: Romantic in spirit, pneumatic in action. But the so-called Baroque revival (the *Orgelbewegung*, or ORGAN REFORM MOVEMENT) did more harm than good, refurbishing historic organs along imaginary "authentic" lines. First, some German organists and builders perpetrated such now-lamented undertakings as the demolition of the eighteenth-century organs in Oliwa (Joseph Geebel, 1935), and Frombork/Frauenburg (Emanuel Kemper, 1935). Some Polish clergymen, builders, and organists adopted the concept, with a considerable time lag caused by World War II, in the late 1940s and '50s, when the original Orgelbewegung ideology was already under fire. Further well-intentioned damage was committed, in spite of frantic efforts to save instruments on the part of the historic organ conservation movement. Even if not always successful, the movement conducts a large-scale inventory of old organs (as part of the Historical Monuments Documentation Center, Ministry of Culture, Warsaw) to help protect them from vandalism, under the National Historical Relics Conservation Act.

The independence of the Polish Catholic Church leaves the question of church organ preservation in the church's hands. There are however, examples of good care and treatment of historic instruments. A number of these monuments underwent properly conducted restoration, mostly by the government-controlled workshops. Several others are under conservation, preceded by a thorough technical and historical study. These studies as well as regional organ catalogs are occasionally published in a special series. Pneumatic and electro-pneumatic actions have dominated the Polish scene much longer than in other countries. Hesitant return to mechanical action came as late as the 1970s but has, since then, gained momentum and some firms can boast of quite decent new instruments of that type.

Once plagued by lower standards in materials and workmanship, local shops, nevertheless, continue to fill most of the country's needs for church organs, whereas music schools and concert halls prefer Czech or German companies (EULE, Rieger, Sauer, Schuke). Of the more than fifty Polish Organ Guild members, only a few have full-scale shops producing large organs (Kaminski Brothers, J. Mollin, S. Sajdowski, D. Szczerbaniak, S. Truszczynski). Others produce chamber organs (Mariusz Syller) or specialize in manufacture of parts and pipes.

See also **East Prussia; Silesia**

JERZY GOLOS

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POMPLITZ, AUGUST (CA. 1825–1877)

Prussian-born American organbuilder. A pupil of the German court organbuilder Eberhardt, Pomplitz emigrated to the United States and established an organbuilding partnership in Baltimore with Henry Rodewald (Pomplitz and Rodewald). The firm lasted from 1851 to 1862, although its factory was destroyed by fire in 1854. In 1862, the firm became the Pomplitz Church Organ Company, where Pomplitz was assisted by his two sons, Hermann W. and Louisa [*sic*] Pomplitz. After August's death in Baltimore on 3 February 1877, Louisa Pomplitz and John W. Otto became the directors of the firm.

The precise number of the firm's output is unknown, but it is estimated to have built about 225 instruments, mostly for clients in and around Baltimore. Pomplitz's largest instruments were for St. James (1868) and St. Vincent de Paul (1873), both in Baltimore. The largest surviving Pomplitz organ was built in 1868, and is currently located at St. Patrick's, Norristown, Pennsylvania.

STEPHEN L. PINEL

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PORTATIVE

A small portable organ, usually suspended from the performer's neck or shoulders. The performer uses the right hand to execute a monophonic line on the KEYBOARD while the left hand pumps BELLOWS at the back or underneath the instrument. The term *portative* is found in literary references as early as the fourteenth century, including Jean de Meung's completion of the *Roman de la Rose*. It is synonymous with the Italian *organetto* and *organino* (both of which reiterate the small size of the organ), but is distinct from the POSITIVE, an organ played with both hands by one person while another person pumps the bellows, and which rests on a table or floor. There is a fair amount of iconographical documentation of the portative, in addition to literary references and archival records such as inventories and payment records. According to Hickmann, medieval sources depicting small organs provide a bridge between the small organs of antiquity and the European portative of the thirteenth to sixteenth centuries. Twelfth-century literary references seem to refer to the use of portatives in ensembles: in Heinrich von Veldecke's *Eneit das Reichsfest zu Mainz*, the organ is used with strings, fiddles, and pipes; the anonymous poem *Leiden und Lebens Jesu, vom Antichrist und vom jüngsten Gericht* has Salome's dance being accompanied with organ, harps, *gigen* (fiddles), and lyres.

The use of the portative within an ensemble is confirmed by its earliest pictorial representations, dating from the thirteenth century. Such ensembles occur most frequently in Psalters (Psalms 1, 80, 97) and Apocalypses, as well as in illustrations of secular texts, manuscript marginalia, and stained-glass windows.

Fourteenth-century manuscripts contain representations of the portative in new contexts, such as an association with angel musicians in Coronation of the Virgin scenes. In addition, the portative becomes an integral part of the instrumentarium used to decorate European churches. Stone sculptures of the portative survive in the portals of Uppsala Cathedral, Freiburg Cathedral, Saint-Ouen in Rouen, and St.-Maurice Cathedral, Vienna. Angelic portative players are also depicted in paintings, wooden altarpieces and choir stalls, and stained glass. Such depictions do not necessarily indicate actual performance conventions; they would instead become decorative motives, used during later centuries. The portative is an iconographical attribute in depictions of King David, St. Cecilia, and allegorical figures representing the sixth liberal art, "Musica." Like the psaltery and cymbala, the portative represents the science of proportions; the relationship between pipe lengths is a practical application of Pythagorean monochord theory. Composers are also represented with portatives: Francesco Landini plays a portative in the portrait on his tombstone; in Martin le Franc's *Le Champion des Dames*, Guillaume Dufay is depicted with what may be a large portative.

The portatives in the earliest depictions are either carried by the organist or held on the knee; they have one or two rows of about eight pipes, often with one or several BOURDON pipes in a tower at one end of the instrument. When keys are shown, they constitute one row under the pipe feet and are clearly played by the fingers of the organist, rather than by the fist or by the entire hand, as was necessary with the contemporary SLIDER mechanism. This implies that a pin ACTION was already in use for the portative, although there is no known mention of it before Henri ARNAULT DE ZWOLLE's treatise (ca. 1440).

An important innovation is the presence of two rows of keys on portatives. One of the earliest depictions, a marginal miniature executed between 1300 and 1325 (Manchester, John Rylands Library, French MS 1, f. 82r), shows a key placement remarkably similar to that of the surviving Norrlanda organ (Sweden), built around 1400. This suggests that the keys on the upper row corresponded to notes outside the diatonic alphabet. Other miniatures of the portative show two identical rows of keys, possibly an artistic shortcut to the exceptional detail of the Rylands miniature. Whatever the exact pitch organization of the keyboard, however, pictorial sources exhibit a growing COMPASS for the portative from the thirteenth through the sixteenth centuries.

Archival documents referring to portative organs often appear to be using the term as a synonym for the positive instead. The instrument acquired by the Burgundian court of Philip the Bold in 1388 had to be carried by two valets. Another Burgundian "portative" organ, brought in 1393 by the dean of the Cathedral of Notre Dame, Paris, was placed in the chapel of the hôtel d'Artois "to play before him [the duke] on solemn feast days." This citation implies that small organs were sometimes used for liturgical music, although true portatives would be very restricted in the execution of polyphony.

Small organs were also very much in demand for the performance of secular music. John I of Aragón attempted to procure the services of the organist Jean de Visée; the correspondence between them makes clear that "Johan del orguens" played the "exaquir o los petits orguens," the latter possibly being a reference to the portative. In addition to providing his own instruments, Visée is requested to bring "the book in which he has notated the *estempides* and other works that he knows how to play on the chekker and organ." The earliest surviving source of keyboard music, the Robertsbridge Codex (ca. 1375), contains three estampies as well as motet intabulations. Similarly, the Codex Faenza contains two-part song and dance intabulations in addition to Mass movements. Although it is assumed that this music was intended for performance by one organist playing with both hands, it is possible that the decorative upper voice was realized on a portative while the lower voice was provided by another instrument. These sources, exceptional in that they contain written evidence of what was almost exclusively improvised music, may provide clues for the style of the portative repertory.

The organological information afforded by surviving Burgundian accounts for the period 1364–1419 is supplemented by iconographical sources and by Arnault de Zwolle's treatise on musical instruments. The document includes diagrams of two portative windchests; one has the usual arrangement of two rows of pipes decreasing in length from left to right, while the other shows two rows of pipes arranged in the shape of a bishop's miter, with the longest pipes in the center. Both portatives have fully chromatic compasses starting at B, with thirty-one and thirty-four notes, respectively. As in the earlier Burgundian examples and because of the weight implied by their relatively large compasses, Arnault de Zwolle's portatives may have been played in a stationery position (i.e., more like positives) rather than suspended from the neck or shoulders. Nonetheless, it seems that they were played like portatives, in the sense that one person manipulated both keyboard and bellows. Arnault de Zwolle describes an ingenious divided bellows system where the upper part of the bellows sends air to the WINDCHEST as it receives wind through a valve from the lower part of the bellows. This system eliminates the breaks in winding created when a single bellows refills, thereby enabling the organist to provide continuous WIND PRESSURE to the portative while he plays.

A similar result was obtained using a double bellows system, where one bellows served as a wind RESERVOIR while another one filled with air. Iconographical evidence for this is found in the painting, "Coronation of the Virgin, with Adoring Angels," attributed to Jacopo di Cione and workshop (ca. 1370; Washington, DC, National Gallery), and a sculpture by Giovanni Tedesco in Florence's Museo dell'Opera del Duomo (1386). Both show two bellows, one behind and another beneath the case of a portative. In fifteenth-century iconography, depictions of the portative proliferate, and larger compasses are shown. The frequency of bourdons and side towers decreases over time; this suggests the decline of a drone tradition and the subsequent use of the portative to play one line in a multilinear texture.

It is clear that by the sixteenth century the term *portative* was being used for table positives. In his *Musica getutscht* (1511), SEBASTIAN VIRDUNG depicts the "portative" as a table positive with one bellows, pipes arranged on one side of the chest in a spiral, and a slightly smaller compass than other organs. The inventory of Henry VIII's instruments (1547) includes references to a "payre of portatives" in a privy chamber as well as to "organes" in the chapel; here the term is used to contrast small instruments for chamber music with larger church organs. Both the instrument in the Musée Des Instruments De Musique, Brussels, and the Copenhagen reconstruction in the Heinrich Schumacher-Museum, Lucerne, contain twenty-six pipes with a short octave. Ironically, in the early seventeenth century, Michael PRAETORIUS uses "positive" to define a "portative" when he describes the "organum portatile" as a positive that can be played as it is carried.

KIMBERLY MARSHALL

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PORTUGAL

In some ways, historic Iberian organs are different in disposition and the sound of certain stops than their contemporary organs elsewhere in Europe. Portuguese organs differ in some respects from those in SPAIN, although in many ways they are similar. A sketch of the early history of the Portuguese up through the mid-sixteenth century will be presented to provide perspective concerning the earliest organ to survive (ca. 1562). Further topics under discussion are: the only organ to survive from the seventeenth century (1696); the many organs that have survived from the eighteenth and early nineteenth centuries; and Portuguese organbuilders and organ buildings after the "Golden Age."

Early History (950–1562)

Extant documents show that several organists were playing in the churches long before the time of Portuguese independence from the kingdom of Léon. "Orgoens" were mentioned in the will of the Countess Mumadona, the founder of the Collegiate of Our Lady of the Olive, erected in Guimarães about 950 CE. Other documents mention organists or *tangedores de orgam* during the following centuries, in the same church, in the Braga Cathedral, and other churches belonging to monastic orders.

Organbuilders like Estevam Dominiques (1337) and Master Garcia (1374) built instruments across the country. Fifteenth-century documents mention other organists working for the king or for monastic orders. Three of them, all named João Alvares, worked as organists, one for Prince Fernando (1437), the second in the monastery S. Vicente de Fora (1486), and the last for João II (1493).

After the Portuguese expansion overseas, during the sixteenth century, several builders worked for João III. Copym de Hollanda, a Fleming, was appointed builder of clavichords, harpsichords, and possibly organs by a royal charter (1523). A Master João worked in S. Cruz de Coimbra (1540). Heitor LOBO worked in the Church of the Order of Christ, in Tomar, in 1534–36. During the last quarter of the sixteenth century, Elias de Lemos was appointed organbuilder to King Sabastião (1577). Salvador Rebelo worked on the organs of the Vizeu Cathedral (1582–83) and Porto Cathedral (1598).

There are two survivals of instruments from the sixteenth century. The 1532 organ at the monastery of S. Cruz de Coimbra (1532) has a small portion of the case left, but the disposition of the original organ is masked by later rebuilding. More impressive is the outstanding mannerist case and embossed pipes of the organ in Évora Cathedral (ca. 1562). As in many Portuguese churches, there were two identical organ cases on opposite walls, one for daily services, the other a larger organ for important celebrations. One of these organs disappeared during the restoration of the cathedral in the mid-twentieth century. As for the surviving instrument, the Italian builder P. C. Oldovini extended the compass to C/E-c''' and changed some stops (1758). Circa 1800, two half-stop EN CHAMADE REEDS (Bass 8' Trumpet and Treble 8' Trumpet) were added by an unknown builder. This rebuilding makes it difficult to determine the nature of the original 1562 organ. (The 1967–69 restoration of the remaining organ is described in Vente and Flentrop.)

The Golden Age (1563–1807)

From 1580 to 1640, Portugal was dominated by Spain; it was a time of economic difficulties and insurrection. Although it is known that organs were being played all over the country, organ building declined. After achieving independence in 1640, recovery was slow. Except at the Cathedral of Miranda do Douro (1696; see stoplist below), no organs survive from the seventeenth century.

However, there was a vigorous revival of organ building in the eighteenth century, fostered by renewed prosperity. Old organs quickly disappeared as they were replaced by new ones, sometimes going to the builder as partial payment. Among the organbuilders of the first half of the eighteenth century, the German J. H. Hulenkampf, a follower of Arp SCHNITGER, installed or built three organs (1711–21), including that of Faro Cathedral. The Spaniard builder Manuel de S. Benot Gomes rebuilt the Santa Cruz organ, Coimbra (1719–24) and is alleged to have built the organ at S. Vincente de Fora, Lisbon (see specification below). Another Spaniard, Simon Fontanes, moved to Portugal and built the organs at Braga Cathedral (1727–1728). Native Portuguese builders included L. Conçeição, F. and J. Cunha, and C. B. Pereira.

After initial recovery efforts from the calamitous 1755 Lisbon earthquake, Portuguese builders such as Manuel de SÁ COUTO and S. J. Varela began to build new instruments to replace those lost in the disaster. Spanish builders continued to move to Portugal as well, including S. Acunha (fl. 1770s), João Fontanes de Maqueixa, M. Mosquera, and especially the Galician Francisco António Solha (fl. ca. 1755–after 1794). The Italian builder Oldovini, who had worked on the Évora Cathedral organ, also built the organ at Elvas Cathedral (ca. 1777) as well as chamber organs. (An Oldovini chest organ from 1762, originally at Évora Cathedral, is now in the Meadows Museum at Southern Methodist University, Dallas.) He also renovated the Hulenkampf organ at Faro Cathedral. Oldovini's organs had very few half-stops and a substantial number of undivided stops, after the Italianate manner.

The flourishing revival of organ building culminated in the commissioning of six organs for the royal basilica at Mafra (1806–1807). Two were built by Joaquim A. P. FONTANES, possibly a descendant of Simon Fontanes, who had built the Braga Cathedral organs. The other three were built by António MACHADO E CERVEIRA, who built over one hundred organs in his lifetime and was granted a coat of arms in 1787. Cerveira finished the Mafra gospel organ in 1807; this one-manual instrument, with its neoclassical case (C-f''', no pedal; divided registers; two Pedals dos Cheios; see below), was restored in 1972 by José Ramos Sampaio, patriarch and pioneer of organ restoration in Portugal. Cerveira finished the organ on 4 October 1807; fifteen days later, General Jean-Andoche Junot crossed the Spanish frontier with thirty thousand French troops and orders from Napoleon Bonaparte to march on Lisbon. The Napoleonic Wars had begun for Portugal.

Construction

Portuguese organs usually had one KEYBOARD. However, larger organs in the eighteenth century would sometimes have two keyboards: the upper, Órgão Principal (GREAT Organ), and the lower, Órgão do Éco (ECHO Organ), containing softer stops in a separate windchest. Certain individual stops in the Órgão do Éco were enclosed, with a movable lid or door that could be opened and closed by a horizontal foot stirrup (but did not operate like a swell with its gradual dynamic changes). As a result, three dynamic levels of tone could be produced: loud on the Órgão Principal, soft on the Órgão do Éco, and a medium level when the door was opened on an enclosed stop. One such manual is part of the Fora, S. Vincente organ. A smaller echo arrangement was that of the single-manual Lisbon, S. Roque organ, 1784 (repl. 1962), with three enclosed treble registers: Clarinete-éco, Corneta 4 filas-éco, and Flauta da ponte-éco. If there was only one éco stop, it would have been a Corneta-éco (which came from Spain in 1670). The Oldovini organs at Évora and Elvas Cathedral had a second manual for treble Corneta d'écos only, now using a pedal to open and close the éco box.

Portuguese organs generally did not have separate Pedal divisions, nor did the literature often require their use. Some organs had PULL-DOWN pedals from low bass notes of the keyboard. Portuguese organs also did not use couplers. The resulting keyboard ACTION was very light and fast, an advantage in the performance of music at a fast tempo on a Portuguese organ.

The *medio registo* (DIVIDED STOP), in which the manual is divided at c'/c♯' with separate stops for top and bottom halves of the keyboard, was widely popular in Spain by 1600; when it first appeared in Portugal is not known. It can be difficult to play music for divided register on a modern instrument, for the right hand can be forced to reach below c♯ into the accompaniment part. This does not translate well into music for two manuals with contrasting tone colors. An organ contract for Lénida Cathedral in Spain (1624–25) indicates some registrational practices that put bass and treble voices in the same tessitura. Sometimes, Iberian music using divided registers is best when played as written—that is, 8' stops in each hand. Furthermore, much of this music is meant to be played with undivided register, drawing equivalent stops in each half of the keyboard.

The typical organ keyboard range of the first half of the eighteenth century was C/E-c''' or d'''. The bass short octave had C (tuned to E), D (tuned to F♯), E (tuned to G♯), F, G, A, and chromatic thereafter. Exceptionally, the University of Coimbra Chapel organ (1733) had a chromatic bass from C. Few fully chromatic bass octaves are found on surviving organs built between 1700 and 1750 (although many were undoubtedly lost in the Lisbon earthquake and for other reasons). Of the 105 extant sonatas by Carlos Seixas (1704–1742), thirty-four were specifically for organ; of these, nineteen can be played on a short octave instrument, and fifteen require a chromatic octave. Ten can be played with meantone tuning, while twenty-four require well-tempered tuning. Later in the century, the chromatic octave from C was standard, and the treble range could go as high as f'''. However, some short octave instruments continued to be built and the old short octave instruments remained.

Like their Spanish counterparts, Portuguese organ cases received considerable attention as to their appearance (at corresponding cost), full of gilding and complex ornamentation. The remarkable organ cases of the Braga Cathedral (1727–28), by the celebrated woodcarver, Marceliano de Araujo, are a triumph of Baroque style. An example of a Rococo organ case, painted white with gilt decorations, stands in the Convent of S. Salvador, Grijó.

Stops

Portuguese organ pipes are measured in *palmos* (spans). An 8' pipe equals 12 *palmos*; a 16' organ pipe equals 24 *palmos*, while a 4' pipe equals 6 *palmos*. (The Spanish *palma* is smaller; an 8' Spanish organ pipe equals 13 *palmas*.) Older stoplists suggest that reed stops were used in many works which would be registered for flue choruses today.

The Portuguese Flautado (PRINCIPAL), generally with low WIND PRESSURE (between 2" and 2.5"), had a gentle, mellow sound and was not as assertive as similar stops in other nations. After the Reformation, the Prinzipal stops in most German organs, for example, were made more aggressive in order to accompany congregational singing. The Principal stops of Iberia, Italy, and other countries retained their softer tone. In addition to Flautados, Spanish stoplists (organ contracts for Barcelona, 1613, and Lérida Cathedral, 1624–25) indicate the use of gapped Mixture stops such as 8' + 2'; 8' + 1-1/3'; 16' + 4'; or 16' + 4' + 2-2/3'. It is possible that this applied to Portuguese music as well.

Most (if not all) surviving Portuguese organs from 1562 to 1807 had Flautas (FLUTES) of various kinds and pitches. Though some organs with divided stops had bass and treble flutes, most organs had treble flutes only. The gentle bass Flautados blend well with the treble flutes.

The Tambor (DRUM PEDAL) comprises a pair of open 8' wooden pipes detuned so, sounded together, they produce acoustic "beats." Some organs had two Tambors, each operated by a pedal, the lower pitched at D and the higher a fifth above (A) in imitation of timpani and their predecessors; sometimes other pitch pairings were used. Drum stops were found from the sixteenth through the eighteenth centuries.

Cheio (Port. "full," "complete") is the generic term for MIXTURE, typically octaves and fifths. The addition of Cheios to Flautados provides a bright tonal contrast to the mellow Flautado tone. This effect could be produced instantly on those organs with a Pedal dos Cheios. This device entailed one ventil pedal, occasionally more, that could engage or disengage wind channels to various parts of the organ: usually just Cheio stops, but on occasion Palhetas (reeds), or, at Lisbon, S. Engracia (late eighteenth century), even Flautados. The 1733 organ at the University of Coimbra Chapel is an extreme and unique example: one manual, with sixteen wooden pedals controlling eight stops on the three windchests (eight blocking airflow, eight reopening it), including an Éco pedal. The more usual single Pedal dos Cheios was rare in the early eighteenth century but became frequent in the last half of the eighteenth and early nineteenth centuries.

The treble Corneta mixture was the most important solo stop, present in almost all organs from no later than 1696. There are four kinds of treble Cornetas: Corneta imperial (I-VIII), as found in the São Vincente organ); Corneta real (Royal Cornet) (II-VIII); Corneta Inglesa (English Cornet), beginning at the Fifteenth (IV-VI); and the Cornetilha (Small Cornet), from the Twenty-second (VIII-XII). A Nazardos mixture which includes a Tierce (III-VI) becomes a bass Corneta; a second bass Corneta is the Clarão (II-VIII), as found in the São Vincente organ. The Corneta de éco is a treble cornet enclosed in an éco box, with a movable door controlled by a foot stirrup. The Corneta always has a Tierce.

The most common Trumpet stop is the Trombeta real; its full-length conical RESONATORS were always located inside the case and milder in sound than the horizontal reeds. A Clarim (8' Trumpet, more strident than the Trombeta real) is found in the Miranda do Douro organ. Palhetas are found internally in the Órgão do Éco; in the treble, Clarim de écos (8' Trumpet, *éco* box, a movable door controlled by a foot stirrup); Clarineta de Éco (*éco* box, movable door); in the bass: Fagote (Bassoon); Trombeta bastarda (8' Trumpet, shortened resonators). These vertical and internal reed stops produce an intense sound found in central European Renaissance trumpet stops. A contract for Lérida Cathedral, Spain (Tellez, 1544,) refers to a "stop of natural trumpets in the German style, with their voices as strong as any in all Germany" (see Wyly, "The Pre-Romantic Spanish Organ"). German Baroque trumpets had a more silvery sound with an emphasis more toward the fundamental.

Horizontal facade (*en chamada*) reeds first appeared in a Basque organ in Spain in 1659; they were later described as being "placed in the main cornice like cannons which will beautify all the facade of the organ." The penchant for horizontal reeds spread throughout Iberia and her colonies but remained unknown elsewhere. These stops enhanced an already intense Renaissance sound and were present in Portuguese organs in profusion by the 1730s. Treble *en chamada* include the Clarim (8' Trumpet), Trombeta Marinha (8' Trumpet, larger resonator), Trombeta Magna (16' Trumpet), Oboe (8'), Clarineta (8'), Dulçaina (8' Regal); horizontal bass reeds "en chamade" include Baixão (8' Trumpet), Trombeta de Batalha, (8' Battle Trumpet, large resonator), Baixãozinho (4' Bass Trumpet), Fagote (8' Bassoon), Chirimia (4' Schalmei), and Dulçaina (8' Regal). Some of these reeds are found in the São Vincente organ.

There is some documentation of registration practices, although more of it is from Spanish than Portuguese sources. References in the anonymous *Declaration de los Organos* (Spain, ca. 1700) indicate that mixtures were sometimes used together with reed stops. The Iberian fondness for contrasting tone colors in the same tessitura certainly applied with reed stops. Many kinds of music, including fugues, were frequently registered for equivalent reeds in both hands. The expected registrations of Principals were used, if less frequently. Sometimes a trumpet would be backed by a Tolosana (Spanish high-pitched cornet) in the same half of the keyboard. Frequently one-half of the keyboard would have a reed and the other half a cornet. The stoplist for Lérida Cathedral (1624–25) indicates that regals were sometimes combined with flue stops of a higher register, such as 8' Regal + 4' + 2-2/3'. A reed chorus is described in Fernando Antonio de Madrid's *Cartas Instructivas sobre los Organos*, 1790: Bajoncillo + Clarín Real or Clarín de Batalha (both hands) + Chirimia + Trompeta Magna. This constitutes "a complete *lleno de lenguetería*" [reed chorus], producing a satisfactory balance of two 8' reeds in the bass and three 8' reeds in the treble.

The Rouxinol (VOGELSANG) found in certain organs throughout the eighteenth century "admitted air to four to six small pipes whose ends were irregularly cut, bent over, and partly immersed in water." The anonymous writer of *Declaration de los Organos* recommended the Nightingale be used with Flautado or Flautado and Flautas: "the Flautas with Ruysenor [Nightingale] . . . comes out well together with the Tambor."

Carrancas (automata) were found occasionally throughout the eighteenth century. The Braga Cathedral gospel organ, 1737, has a device to activate an angel blowing a trumpet. In other churches there are movable sculptures as well. In Amares, Senhora da Abadia (1798), there is a mask under the gallery, "opening the mouth and giving a sound . . . worked by a lever . . . in the floorboard" (Azevedo).

Unlike some Spanish organs, Portuguese used no tremulants except for the Voz Humana, a Céleste treble stop. Rare in the early 1700s, it was much used in the last half of the eighteenth century. (For information on Portuguese stops, pipes, etc., see Wyly, "The Pre-Romantic Spanish Organ.")

***The** Miranda do Douro Cathedral Organ (ca. 1696)*

The only seventeenth-century Portuguese organ still extant is attributed to Geraldo Vieira Porto. The instrument was rebuilt in 1904 by Juan Bernardi Borrino, an Italian builder who installed a new keyboard (C-c'''), and restored in 1943 by José Ramos Sampaio. The manual is divided at c'/c♯'; twelve pull-downs connect to the keyboard's lower octave (see section above for translations of stops; all pipe lengths in *palmos* in italics):

Bass Register (to c'):	**Treble Register (from c♯):**
Flautado *de 12* (8' Principal)	Flautado *de 12*
Violão (8' Stopped Principal)	Violão
Oitava real (4' Principal)	Oitava real
Quinzena (Fifteenth)	Quinzena
Cheio (three ranks)	Cheio
	Corneta [real] (II-VIII)
Trombeta real	Trombeta real
Clarim (8' Trumpet)	Clarim

Fora, São Vincente (First Third of the Eighteenth Century

One of the biggest organs ever built in Portugal, this instrument has been attributed to Benot Gomes. (See Pereira, "A Notable Organ in Portugal.") Despite damage to the church's dome and front during the 1755 Lisbon earthquake, its organ survived. It was repaired in 1957 and later restored by José Ramos Sampaio (1977–82). Compass is C/E-d''', with divided registers at c'/c♯'. There are two manuals, Great Organ (upper) and Echo Organ (lower), three pedals for the Tambor stop (one per pair of pipes); and a stirrup to open and close the echo box (see section above for translations of stops; all pipe lengths in *palmos* in italics; tapado = stopped; MX = Mixture):

GREAT (upper manual)

Bass Register (to c')	**Treble Register (from c♯)**
FLUE STOPS	
Contras *de 24* 16' (Principal)	Flauta Travessa 8' (Flute)
Flautado *de 12* tapado 8'	Flauta doce 4'
Flautado *de 6* tapado 4'	Flautado *de 12* 8
Flautado *de 12* 8'	Flautado *de 24* 16'
Flautado *de 24* 16'	Oitava magna 16'
Oitava real 4'	Oitava real 4' (Principal, 2 ranks)
Quinzena (15th)	
Clarão II-VIII	Corneta real I-VIII
Quinta real	Quinta *de 12* (2 ranks)
Mistura imperial (MX, two ranks)	Decimaquinta (15th; MX 4 ranks)
Dozena (12th; 2 ranks)	Mistura imperial (MX 6 ranks)
Vigésimasegunda (22nd; 2 to 3 ranks)	Clarãozinho (Cornet, 7 ranks)
Subcímbala (Sharp MX, 4 ranks)	Subcímbala (Sharp MX, 4 ranks)
Címbala (Sharp MX, 4 ranks)	Címbala (Sharp MX, 4 ranks)
REED STOPS (en chamade unless indicated)	
Trombeta real 8' (Trumpet, vertical)	Trombeta real 8' (vertical)
Trompa de Batalha 8' (Battle Trumpet; longest, loudest resonator)	Trombeta Marinha 8' (Marine Trumpet; large resonator)
Baixãozinho 4' (Bass Trumpet)	Clarim 8' (Trumpet, shorter resonator)
Chirimia 4' (Schalmei, small resonator)	Boé 8' (Oboe, small resonator)
Dulçaina 8' (Regal, small resonator)	Dulçaina 8' Voz Humana (8' Celeste)

ECHO (lower manual)

Bass	Treble
Flautado violão 8' (stopped Principal)	Flautado *de 12* éco 8' (echo box with door)
Flautado *de 6* tapado 4'	Flautado *de 12* tapado 8'
Flautado *de 12* 8'	Flauta napolitana 8'
Quinzena (15th; one to two ranks)	Flauta *de 6* 4'
	Oitava 4' (Principal, 2 ranks)
	Pifaro (Pfeife, 2 ranks)

Dezanovena
(19th; 1 to 2 ranks)
Vintedozena (22nd; 2 ranks)
Nazardos III-V
(echo box with door)
Tolosana (Sharp MX, 3 ranks)

Sacabucha 8' (Trumpet, vertical)

Vintedozena
(22nd; 3 ranks)
Cornetilha VII-XII
Corneta II-VIII
(echo box with door)
Cheio claro VIII-XXXII
(octaves, fifths)
Clarim-éco 8'
(Trumpet, echo box
with door)

The Portuguese Organ after 1807

The Mafra organs by Fontanes and Machado e Cerveira marked the last gasp of the Portuguese Baroque/classical organ. The nineteenth century saw a dramatic decline in the building of new organs, due primarily to economic troubles and the directing of whatever resources were available toward maintaining Portuguese colonial and postcolonial interests. Sá Couto built neoclassical instruments well into into the 1830s. Later native builders included Francisco Manuel Ferreira (Estrela, Dos Milagres, 1845; 45 stops); José Joaquim Fonseca (Foz do Sousa, parish church, 1863; 1/12; rest. Machada, 1993); the Dos Santos family, notably António José dos Santos (Porto, S. Francisco, 1873); and Augusto J. Claro (Beiriz, parish church, 1894; 1/14; rest. Machado, 2001).

A new trend emerged during the second half of the nineteenth century: the importation of instruments, especially from Great Britain and Germany. J. C. Bishop placed an organ at the seminary church in Santarém (ca. 1840). The Walker firm erected instruments at Lisbon, National Conservatory; Braga, Montariol Convent (1868; 1/7; rest. Machado, 2003); Azores, São Miguel (1882; rest. Machado); and Porto, Rio Tinto, Anglican Church (1913). The Scottish-born Peter Conacher built organs for Lisbon, Carmo (1881) and Coimbra, Tesouros, Nossa Senhora da Esperança (1891). Lesser-known British builders such as T. A. Samuel and William Sweetland also erected instruments here.

Although German manufacturers started exporting to Portugal later than the British, they would eventually dominate the market there; the historic connection to Schnitger's organs probably played a part in this. These builders included E. F Walcker (Lisbon, National Conservatory, 1933; 2/10; rest. Machado, 1993), K. Lötzerich, D. A. Flentrop (Lisbon, Epistolic, 1964; 4/51); Willi Peter (Lisbon, German Evangelical, 1966; 2/21), Schuke/Potsdam (Costa Nova, 1978), Georges Heintz (Conceição, Nossa Senhora, 1998; 3/44), Kuhn (Cedofeita, 2000; 3/36), E. Pfaff, Gerhard Grenzing, and Georg Jann (Porto, Nossa Senhora da Lapa, 1995, 4/65). After completing the Nossa Senhora da Lapa organ, Jann decided to remain in Portugal to found Orguin Pipe Makers in Avidos, Braga. Other foreign builders represented in Portugal include Cavaillé-Coll–Mutin, Ruffatti, and Tamburini.

The Portuguese organ-building trade has seen a rebirth in the last quarter of the twentieth century. Although some new instruments are being built, more time is being spent restoring or reconstructing long-neglected "golden age" instruments from between the sixteenth and early nineteenth centuries. Among those involved in these activities are Jorge Barbosa, Francisco Falcão, Pedro Guimarães, Miguel Hensberg, Dinarte Machado, and António Simões. In 1992, Guimarães founded the Oficina e Escola de Organaria (OEO), a school and organ-building firm, with the assistance of Jann and others. It has been located in Esmoriz, Porto, since 1996. Both Machado and the OEO have restored a wide range of instruments by important Portuguese and foreign builders.

Like other Portuguese cultural institutions since the return of democracy in 1974, the organ scene has regained its prestige, reclaiming past glories as well as pursuing greater performance and compositional opportunities. The Associação Portuguesa Amigos do Órgão is the primary support group in the country. There are two major organ events: the Festival Internacional de Órgão de Lisboa (founded 1998), and the Festival de Órgão do Palácio Nacional de Mafra, celebrating the six Fontanes and Cerveira organs from the early nineteenth century (rest. Machado, 1989–2002).

Jane L. Johnson
Richard Kassel
L. A. Esteves Pereira

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POSAUNE

See Trombone/Posaune

POSITIV

(Ger.; Fr. *Positif*; Dutch *Positief*) A sixteenth-century term; in this encyclopedia, the capitalized German spelling denotes a DIVISION within a larger organ. (The other meaning, a kind of independent CHAMBER ORGAN, is spelled as *positive*, not capitalized, in this encyclopedia; see the entry for POSITIVE.) Both meanings relate to the RÜCKPOSITIV (Fr. *Positif de dos*; Dutch *Rugpositief*), a small organ located behind the organist, requiring the performer to turn around to face a separate KEYBOARD, hence "back positive." The Rückpositiv was given divided slider-chests (and thus the possibility of stops) to complement the undivided mixture of the BLOCKWERK (Dutch *Blokwerk*) main organ chest. In any case, the division (like the instrument) may feature the characteristic high-pitched stops and short-resonator reeds of late medieval positives.

Dutch builders such as Jacob van Bilsteyn (Delft, Old Church, 1455) and van Elen (Maastricht, St. John's, 1423–5 and Utrecht Cathedral, 1434) built these organs with Rugpositiefs; incorporated divisions were called Positiefs. Arnolt SCHLICK (1511) uses the term *Positiv* to describe a division within a larger organ; this practice had already been established by organbuilders. In France, the designation of a secondary division as a Positif became common after about 1520; before this time, it might denote a small independent organ. English builders, who retained Rückpositivs longer than other national schools, called them CHAIR ORGANS; once incorporated, they were generally were known as CHOIR organs or divisions.

The most common placement of the Positiv CHEST was above the CONSOLE and below the main chest (Brüstungspositiv), but there were other options, such as the space above the main chest (a kind of OBERWERK), or divided into a pair of smaller chests, one on each side of the organist. A Positiv division was not necessarily a small one when compared to the main division; it might have a different distribution of stops or fewer choruses, but was not intended as an "echo division" per se. From the eighteenth century on, the English Chair or Choir gradually acquired expression in the form of an enclosed box with movable shade; by the Romantic era, all but the largest organs had replaced the Positiv with the SWELL division. In the "authentic" mood of the ORGAN REFORM MOVEMENT and especially since World War II, builders not interested in an eclectic approach (e.g., American classic) have often returned to the Positiv at the expense of the Swell.

KIMBERLY MARSHALL

POSITIVE

(Lat. *ponere*, *positum*, to place). An organ that rests on a surface such as a table or floor, and whose keyboard is played with both of the organist's hands while another person pumps the BELLOWS. The term is used to distinguish a small, stationary organ with two bellows from a PORTATIVE, usually a smaller instrument to be operated by one person, who carries it on a strap from the neck or shoulder, plays the keyboard with one hand, and pumps the single bellows with the other hand. (The capitalized German term POSITIV is used in this encyclopedia for the organ DIVISION.)

Strictly speaking, the earliest depictions of pneumatic organs, in sources such as the Harding Bible (1109) and the Pommersfelden Psalter (ca. 1070), represent positives, since they are stationary while they are played. In these examples the SLIDER mechanism necessitates the use of both hands; the performer pushes in a slider to stop a note from sounding with one hand while the other hand pulls out the slider for the next note. Unlike the portative, the positive required an additional person to pump the bellows. In the case of portative organs, which begin to appear in thirteenth-century manuscript illuminations, the instrument's limit of one playing hand requires a new type of KEY mechanism, most probably a pin ACTION; the slider action shown on eleventh- and twelfth-century positives was impractical for the portative.

This pin action may have prompted the reintroduction of a key action in larger organs. The eleventh-century treatise of Anonymous of Berne describes a key

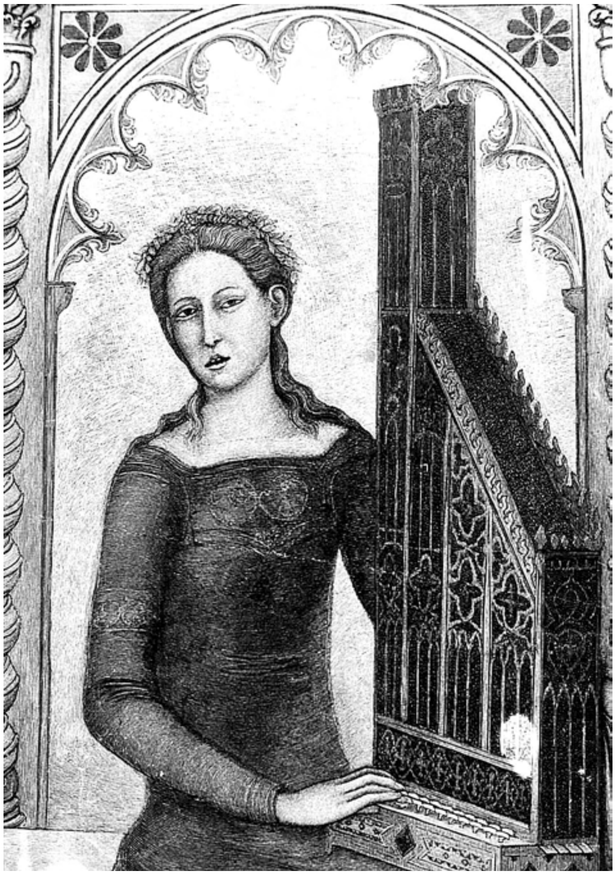

Fig. 63. Positive.

action similar to that documented by Hero of Alexandria (first century CE), where a depressed key moves a slider so that a hole in the slider is aligned with the pipe foot, thereby admitting wind into the pipe, causing it to sound. The use of keys (depressed by individual fingers) rather than sliders (requiring whole hands) produced a new type of positive organ, first documented in the ICONOGRAPHY of the thirteenth century. The positive depicted in the Rutland Psalter (now London, British Library Add. MS 62925, ca. 1260) has one row of adjacent keys played by the organist's fingers, two rows of pipes of gradually descending length, and a BOURDON pipe at the treble end, where a man pumps two large bellows with his feet. The general outlines of this positive are maintained in the many manuscript illuminations showing positive organs during the fourteenth and fifteenth centuries. While they resemble large portatives, their larger size and weight dictate that they must rest on a surface and require a larger wind supply than that provided by a single portative bellows. The positive is a common iconographical attribute in depictions of King David, Saint Cecilia, and allegorical figures representing the sixth liberal art, "Musica."

Iconographical evidence suggests that the COMPASS of the positive's keyboard increased with time; the larger compass made it possible for organists to execute two parts at once. This was probably not the case in the thirteenth century, as shown in the Rutland Psalter, where the organist's hands seem to alternate in performing a monophonic line. The movement from monolinear to plurilinear playing would explain the decline of a drone tradition in keyboard performance, and hence the less frequent presence of bourdon pipes in fifteenth-century depictions of the positive.

The expansion of the keyboard necessitated the inclusion of an additional row of keys for pitches outside of the diatonic alphabet. Jacobus of Liège, writing around 1330, specifies that in certain instruments, including the organ, almost everywhere the tone is divided into two unequal semitones (based on PYTHAGOREAN INTONATION). The appearance of a second row of keys on positives is undoubtedly related to the inclusion of these new pitches. A particularly important document for this keyboard evolution is the positive painted in the Ghent Altarpiece by Jan and Hugo van Eyck. Ripin has shown that the keyboard of this positive originally resembled that of the surviving Norrlanda organ in Sweden (ca. 1400), with two separate rows of identically formed keys. When the altarpiece was repainted in 1432, the keyboard was "modernized" and block-form chromatic keys were interspersed with the diatonic ones, much like a modern keyboard. The compass was also changed from a diatonic lower octave beginning on G to a fully chromatic keyboard beginning on B. The key located below and to the left of this positive has inspired much discussion; it has been proposed that the key shut off one row of pipes, that it activated a drone, or that it merely emptied the WINDCHEST after playing.

Four sliders for separable STOPS or registers are clearly shown on the positive in Israel van Meckenem the Younger's engraving of a bourgeois organ-player and his wife (for a reproduction, see MEDIEVAL AND RENAISSANCE ORGAN). A similar function may have been served by the two sliders on the positive in a painting of Saint Cecilia by the Master of Saint Bartholomew (ca. 1510), now in Cologne's Waliraf-Richartz Museum.

Archival sources also document the use of positives; but written references to portatives and positives are often ambiguous. Thus, the "portatives" mentioned in the account books of Philip the Bold's court probably referred to table positives. The term *positive* probably distinguished larger chamber organs from smaller table positives. The care and expense lavished on positives at the Burgundian court is fully documented in the account books.

Henri ARNAULT DE ZWOLLE describes a *tergali positiv*, which may have been a RÜCKPOSITIV, with a three-octave compass of FG-f'' at 4' pitch. This remarkable instrument contained 195 pipes, with a four- to seven-rank Blockwerk of octaves; this is clearly a small-scale version of Blockwerks found in large churches, where numerous ranks doubling the octave and fifth reinforced the sound in a large room. Arnault de Zwolle also provides information about two portative chests (*ciste portivorum*), which may have been portative-positive hybrids that were too large for the player to carry. Both "portatives" have fully chromatic compasses of thirty-one (b-f’’’) and thirty-four (b-g’’’a’’’) notes, the latter's pipes arranged in a "bishop's miter." Arnault de Zwolle specifies that a double bellows system can be used to provide continuous wind to the portatives, strongly suggesting that one person could manipulate the bellows and play the keyboard simultaneously. It is possible that the weight of such organs was minimized through the use of paper pipes, such as those of the surviving Lorenzo da Pavia organ (1494), a larger positive with two rows of pipes in a MITER arrangement.

In the fifteenth century, the lines of distinction between portatives, positives, and even larger church organs (*organum*, *opus*) become increasingly blurred. As Hickmann notes, a positive can be a stationary organ played like a portative, a chamber organ with separable stops, a small Blockwerk, or a division of a larger instrument, as in the contracts for the Zwolle Liebfraukirche (1447) and Delft Oude Kerk (1455). Many instruments called "portatives" are of a size that requires a resting surface, i.e., they are positives, technically speaking. Examples are found in Ammerbach's *Tabulatur-Buch* (1571) and in the woodcut from *The Triumph of Maximilian* (ca. 1519). The latter shows a positive organ on a table inside a wagon; it is being played by both hands of the organist (perhaps Paul Hofhaimer), and a large bellows at the back of the instrument is being pumped by a CALCANT.

Sebastian VIRDUNG's *Musica getutscht* (1511) depicts four keyboard instruments for which wind is supplied by bellows: an "orgel," a one-manual organ with a decorative facade; a table "positive" with two bellows, two ranks of pipes, and the same compass as the "orgel"; a "regale" with three bellows (no keyboard is shown); and a "portative," actually a table positive with one bellows, pipes arranged on one side of the chest in a spiral, and a slightly smaller compass than the other organs. Surviving "portatives" from the early sixteenth century are too large to be truly portable, including the Brussels museum instrument, with twenty-six keys in a modern arrangement and pipes in two rows, e’-f’’’. The Copenhagen reconstruction of the instrument in the Heinrich Schumacher-Museum, Lucerne, also contains twenty-six pipes, including a short octave. Its *H*-shaped mouths greatly resemble those of the Brussels instrument. Other surviving positives are those in the Berlin Staatliche Instrumentensammlung (ca. 1700) and Belgium's Pensionnat de Berlaymont (fifteenth century?), with twenty-five keys and two detachable bellows, most likely a REGAL.

Michael PRAETORIUS (1619) reserved the term *positiff* for table organs with two bellows, which were considered too small to be considered full *Orgelwercken*. If the positive had pipes larger than the usual 2’, it was called a *Grosspositiff* or *Kirchenpositiff*. Jacob ADLUNG (1768) distinguishes the small *Positive*, with no Principal rank larger than 2’, from the larger *Orgel*.

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POST HORN

A stop, also called the English Post Horn, invented by Robert Hope-Jones as a loud and brassy 16' reed stop for his Swell divisions. First called Double English Horn, its tone was nothing like the gentle tone of the English Horn of the classical organ. Like other stops developed by Hope-Jones, the English Post Horn found its true home in the theater organ, where it appears at 8' and 16' pitch. Walter Strony calls it "the king of theater organ chorus reeds," and considers it an essential part of any theater organ of a dozen ranks or more. On the theater organ, the name English Horn is a synonym for English Post Horn.

See also **Stop**

Edward L. Stauff

POUCH OR PUFFER NOTE CONTROL

An inflatable leather purse used in a variety of actions. It was introduced in 1827 by Josiah Booth of Wakefield, England, to draw down large pallets in an otherwise conventional mechanical action (Hopkins and Rimbault). These "puffers" were small pneumatic bellows, but the term usually applies to a single flexible pouch found in the windchest.

The pouch is used in the sliderless membrane-chest developed in the nineteenth century by German and American builders. Pipes are prevented from speaking by the pouches, which are pressurized from note channels below. When the key channels are not pressurized, the windchest air feeding the pipes forces the pouches down, permitting speech. The design, although simple, means that faults in note channel pressure will not result in unwanted pipe speech.

The system is easily adapted to the unit chest, and twentieth-century developments included the removal of internal channels. In this design, all pipes sit over a common wind supply. When a note is played, the air cell beneath the pouch is connected to the outside of the windchest, which causes it to deflate and permit pipe speech. When the note is released, the pouch is reconnected to the internal windchest pressure, and a spring ensures swift inflation. The logic of stop and note control is entirely external to the windchest in this design, and it gives freedom to place pipes for best speech and weight distribution. A refined variant of this is Schoenstein's expansion cell design.

As the pouches in most cases are both part of the action and act as pipe valves, they are under constant pressure, so they wear faster than other leather parts. For this reason, E. F. Walcker rejected them in favor of the ventil chest in 1893.

Alastair Disley

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PRAETORIUS, MICHAEL (1571–1621)

German organist, composer, author, theorist, and organ expert. After spending three years as organist of St. Marien in Frankfurt, he moved to Wolfenbüttel, where for most of his career he served the court of Brunswick-Wolfenbüttel, first as organist, then Kapellmeister (from 1604). After the death of Duke Heinrich Julius in 1613, he spent much time at the electoral Saxon court in Dresden and undertook numerous other professional engagements.

Praetorius clearly possessed a profound and wide-ranging musical talent, but remained first and foremost an organist. He was among an illustrious group of German organists who took part in the examination and dedication of the organ in the castle chapel at Groningen, completed in 1596 by David Beck (2/59). As late as 1619 Praetorius performed, together with Heinrich Schütz and Samuel Scheidt, at the dedication of the new organ at the Bayreuth Stadtkirche.

Praetorius's organ works form a limited but significant part of his compositional output. His collection, *Musae Sioniae* VII (1609), ends with two variations on the chorale "Nun lob, mein Seel, den Herren" and three large fantasies on the hymns "Christ unser Herr zum Jordan kam," "Ein feste Burg ist unser Gott," and "Wir glauben all an einen Gott." The *Hymnodia Sionia* (1611) contains six hymn settings of more modest dimensions, all featuring the chorale in the bass.

In addition to his talents as a performer and composer, Praetorius wrote the ambitious three-volume treatise *Syntagma musicum*, the most complete treatment of musical matters attempted up to its time. Volume I is primarily a history of religious music and various liturgical-musical forms; volume II treats instruments, both ancient and contemporary; volume III encompasses practical matters of music-making: forms, learning procedures, and performance suggestions. An intended fourth volume, on musical composition, never appeared.

Volume II of the *Syntagma* devotes three parts (nos. 3–5) to the organ, versus two for all other instruments, an indication of Praetorius's esteem for the instrument. Part 3 treats the development of the organ, while part 4 examines characteristics of contemporary organs, including an extensive description of individual stops. Part 5 is a collection of STOPLISTS of important German organs during Praetorius's time.

Volume II, part 4 includes Praetorius's famous description of the Halberstadt Cathedral organ, built by Nikolaus Faber (1359–61; reb. G. Kleng, 1495; lost); unfortunately, Praetorius does not discriminate between the organ's 1361 and 1495 elements. The instrument had four manuals of very limited compass (twenty-two keys in the upper two manuals, twelve in the lower two). The upper manuals ("Claviers I and II") had mushroomlike naturals and shorter sticks for accidentals. The two lower manuals ("Clavier III", "Pedal Clavier") used long sticks for the naturals; Clavier III had accidentals similar to the upper manuals, while the Pedal Clavier had extremely short sticks as accidentals. The organ was divided as follows: Clavier I, full organ—that is, Principal/Prestant plus the so-called Hinterwerk (HINTERSATZ), a chest located behind the Prestant; Clavier II, Principal/Prestant only; Clavier III, the Bassklavier, playing a set of large pipes located to the sides of the main organ; and the Pedal, possibly a pull-down of Clavier I that played the cantus firmus (chorale tune) rather than a bass line. The Halberstadt manuals were not keyboards so much as rows of levers, with space between the naturals and accidentals as well as between levers. Hands, not fingers, were required to play the upper manuals; Clavier III may have been played by hands or knees, the Pedal by knees.

Due to its comprehensiveness as well as its place in musicological history, Praetorius's book is perhaps the most influential German-language book on organ building ever published. At the end of part 4, Praetorius states his intention to collaborate with his colleague, the distinguished organbuilder Esajas COMPENIUS, in publishing a "little treatise" detailing how to examine a newly built organ. That treatise was never published, but it circulated in manuscript copies for several centuries after Praetorius's death and became highly influential. Andreas WERCKMEISTER apparently possessed a copy; his *Orgel-Probe* (1681, 1698) is clearly based on it, as are the writings of Jacob ADLUNG. A copy of the aforementioned manuscript has been preserved in the Herzog August Bibliothek in Wolfenbüttel, and is now available in English translation.

FERDINAND J. DE HEN

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PRATO, LORENZO (DI JACOPO) DA (1417–1492)

Italian organbuilder. Prato was the most influential member of the Tuscan school of organ building centered in his home city of Prato. From about 1454 to 1470 he resided in Siena, constructing organs in that city (S. Agostino, before 1459; S. Maria della Scala, 1460) and elsewhere (S. Francesco, Cortona, 1467; Pistoia, Cathedral, 1476; also Arezzo and Perugia). Prato next lived in Bologna (ca. 1474–ca. 1483), where he built the instrument for which he is best known at the Basilica of S. Petronio. He also built instruments in Padua and Udine. After testing the waters in Naples in 1471, he moved there permanently (ca. 1483); all of his late work (except a 1490 organ in Orvieto) was completed in Naples or its environs, and it was the city in which he died.

The S. Petronio organ in Bologna has kept its original gilded case, now enclosed in a carved stone Baroque shell. The original specification included a Principale 24', Ottava 12', Quintadecima 6', Decimanona, Vigesimaseconda, Vigesimasesta, Vigesimanona, Trigesimaterza, Trigesimasesta, and a Flauto Quintadecima, i.e., a full ripieno plus one flute. In addition to a fifty-one-key manual (FF-GG-AA-a''), it had a pull-down pedal and a spring-chest with copper sliders. In 1528 Giovanni Baptista FACHETTI built a new windchest and lowered the pitch by moving the pipes, adding extra enharmonics (SUBSEMITONES). Over the years the organ has undergone numerous changes, including a restoration (1974–82). The S. Petronio organ currently has the following specifications: Principale 24', Principale 12', Flauto in Ottava, Flauto in Duodecima, Ottava, Duodecima, Decimaquinta, Decimanona, Vigesimaseconda, Vigesimasesta; Pedale, eighteen pull-downs, Contrabassi; a spring-chest, stop levers, and a *tiratutti* (an *organo pieno* device that draws the entire ripieno simultaneously).

THOMAS CIMARUSTI

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PRESCOTT, ABRAHAM (1789–1858)

American musical instrument maker. Prescott made keyboard and bowed string instruments and founded a family business active in the production and sales of instruments for well over a hundred years. Born in Deerfield, New Hampshire, on 5 July 1789, he learned cabinetmaking from an uncle and produced his first bass viol (really a large cello) in Deerfield in 1809. These instruments found a market for use in churches in the leading of singing, and Prescott had built and sold several hundred by the 1840s. Meanwhile, he became director of the singing school at the Atkinson (New Hampshire) Academy in 1811 and served as a fife major during the war of 1812. He soon returned to Deerfield to farm, teach, and build instruments with the aid of apprentices such as David and Andrew Dearborn. His wide musical, religious, and social connections combined with a considerable talent for business to create a thriving musical trade.

In 1831 Prescott opened a shop in Concord, New Hampshire; two years later he moved his entire business there, and erected a sawmill to process timber for the making of musical instruments. On a business trip to Boston he saw an "elbow organ" or lap organ ("rocking melodeon") built by James Bazin. Seeing the potential of this small REED ORGAN, he commenced manufacturing them in 1836 or 1837—both the button (melodeon) and the conventional keyboard type; he also built SERAPHINES. In 1837 the firm displayed instruments at both the New Hampshire State Fair (silver medal) and a fair held by the American Institute in New York. In 1845 he took as his partner his eldest son, Abraham James Prescott, and the name of the firm was changed to A. Prescott and Son (later Sons).

During the years 1845 and 1850, Prescott gradually withdrew from the business, turning the production of viols over to the Dearborn brothers and paying increasing attention to free-reed instruments of various sizes. In 1849 the firm was completely destroyed by fire; rebuilt, it was destroyed a second time in 1851. During this period Abraham Prescott retired, selling out to Abraham James as well as two other sons, Joseph W. Prescott and Josiah B. Prescott, and the firm became Prescott and Brothers. After a short excursion into the insurance business, Abraham Prescott died in Concord on 1 May 1 1858. Joseph W. Prescott left the firm in 1863 and established his own shop, offering chapel organs, melodeons, and organ harmoniums. The remaining brothers renamed the firm Prescott Brothers; in 1868 Josiah died, upon which Abraham J. Prescott took his youngest brother George D. B. Prescott into partnership. The firm produced melodeons, parlor organs, and chapel organs; its name became the Prescott Organ Company in 1871, and was incorporated in 1881.

The company continued to produce a wide variety of organs into the 1880s, but the Prescotts began shifting their efforts toward the piano; their first pianos were built somewhere around 1885; in 1887 the firm's name was changed to the Prescott Piano and Organ Company, Inc. A year later, Joseph W. Prescott died, followed by Abraham J. Prescott in 1891, the last year the firm built organs. The company, now, the Prescott Piano Company, Inc., survived as a piano manufacturer until 1912, closing its retail business through bankruptcy in 1917. Aside from its importance as a builder of reed organs and other musical instruments, the Prescott firm may be considered the founder of a school of instrument makers as well as the establishment of an important center of reed organ manufacture in Concord. Reed organ makers, many of whom were trained in the Prescott firm, included Charles Austin, Daniel V. Bartlett, Ballou and Curtis, Ingalls and Crockett, Levi Lipscomb, Morrison and Courser, Caleb and Samuel Parker, Jacob B. Rand, Daniel F. Secomb, A. V. Severance, and Luther Tracy.

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PRESSURE-PNEUMATIC ACTION

SEE ACTION

PRESTANT

A foundation stop, appearing at 16', 8', or 4' pitches, producing true organ tone. Current practice usually associates this name with a rank at 4' pitch. This stop name may also indicate that part or all of the rank is in the facade of its associated division. Examples of the term being applied to lower registers can be found in the Schnitger organ in Groningen, Aa-Kerk (1700–02), with a Praestant 16' on the Hoofdwerk and an 8' Praestant on each of the Pedaal and Rugpositief divisions; the foundation ranks above the Praestant of each division are labeled Octaaf. On instruments that contain more than one 4' foundation stop within a division, "Prestant" may indicate the primary Principal rank of the division. Examples in Arisitide CAVAILLÉ-COLL's instruments are the inclusion of both a 4' Prestant and a 4' Octave within the Solo division of the one-hundred-rank organ in St.-Sulpice, Paris; the Grand Orgue of the eighty-six-rank organ in Notre Dame Cathedral, Paris; and in the Grand Orgue Expressif of the twenty-two-rank organ in the Chapelle des Jésuites, Lyon. Cavaille-Coll included either a Prestant or an Octave at 4' pitch in other divisions of his larger instruments as well; on instruments with only one 4' foundation stop in a division, Cavaillé-Coll's normal practice was to include a 4' Prestant.

As can be seen by these examples from the Baroque and Romantic eras, there needs to be flexibility as to the application of the term to modern organ design. Terms synonymous with Prestant but with fluctuating meanings include *Diapason*, *Flautado*, *Flautat*, *Octaaf*, *Octava*, *Octave*, *Prästant*, *Praestant*, *Principaal*, *Principal*, *Principale*, *Principalo*, and *Prinzipal*.

See also **Stop**

WILLIAM F. COSCARELLI

PRINCE, GEORGE A. (1818–1890)

American reed organ manufacturer. Prince, born the son of a sea captain in Boston on 17 February, 1818, showed an early interest in music, and worked in his cousin's music store in Boston. After his family moved to Buffalo, New York, in 1833, he opened a branch of the store there in partnership with his cousin; the cousin withdrew after a short time and Prince bought out his interest. He took out several patents (1846) for the improvement of melodeons (a REED ORGAN with a button keyboard) and began to manufacture them above his store. Successive factories of the George A. Prince Company (George A. Prince and Company, Prince and Company) were located at various Buffalo sites.

Prince was the most important reed organ manufacturer in the United States during the middle of the nineteenth century. He was among the first manufacturers to build reed organs on a mass-production basis, producing seventy-five instruments a week. In 1866 he advertised as the oldest manufacturer in the country, claiming to have produced over forty thousand instruments since the company's founding, including melodeons, organ melodeons, school organs, and automatic organs. (This number may have been overly boastful, as the company's consecutive serial numbers had reached only 32,595 by 1871.) Toward the end of the century the business declined and Prince closed the factory, retiring in about 1879. In the following year Samuel N. Prince created a partnership with his brother's former partner, Charles E. Bacon, to carry on the business under the name of Prince and Bacon. George Prince died in Buffalo, New York, on 3 March 1890.

Two important figures in the development of the American reed organ industry were employees at the Prince plant. Emmons Hamlin (1821–1885), superintendent of the tuning department in 1847, developed the technique of free-reed voicing and incorporated a pair of double-bellows during the 1850s, thus opening the way for the production of larger and more powerful instruments. (In 1860 Prince introduced the "New Organ Melodeon," with two manuals, four sets of reeds, and a pedal of one and one-half octaves.) Hamlin left Prince in 1854 and joined with Henry Mason to form MASON AND HAMLIN. Jeremiah CARHART (1813–1868), holder of the U.S. patent for the suction bellows and inventor of machinery for the mass production of reed boards, built his first melodeon with Prince.

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PRINCIPAL

The most characteristic stop of the organ, a flue stop with a rich and balanced harmonic palette (i.e., partials), usually displayed prominently within the FACADE. Like the Flute and Mixture groups, the Principal was separated out of the BLOCKWERK during the Renaissance; its regional evolution meant that the stop appears under different names and with different characteristics. The German *Prinzipal* yields a rounded tone without special accents. The English DIAPASON is a bit brighter (more "silvery") in quality, while the French *Montre* and the Spanish *Flautado* are more flutelike.

The Netherlandish equivalent was called the *Doef* until the early Baroque, when the term *Praestant* became the norm (also used by some German builders).

Terminology for Principal stops varied at different times in different regions. The English Principal 4' was paired with the Open Diapason 8'. The French Montre 8' was coupled with the Prestant 4'. The companion of the Spanish Flautado 8' was named the Flautadito 4'. The term OCTAVE by itself refers to the Principal stop an octave above the primary register (e.g., the 8' of the 16' pedal, the 4' of the 8' manual), much as its addition to any stop name refers to that stop's next highest register. (The FIFTEENTH/SUPEROCTAVE is the stop two octaves above the primary register.)

The Principal CHORUS is the most important in the organ, and organbuilders strive to furnish it as completely as possible, limited only by the instrument's size and expense. As it is impossible for a chorus to provide the complete harmonic content of any fundamental, the first five or six partials are generally furnished as separate stops and the rest in the form of a mixture. For an 8' manual chorus, this translates to a balance combination of Principal 8, Octave 4, QUINT 2-2/3, Octave 2, TIERCE 1-3/5, and Quint 1-1/3; a Mixture VII-X might include different degrees of TWENTY-FIRST/SEPTIÈME 1-1/7, Octave 1, NONE/TWENTY-THIRD 8/9, and Tierce 4/5. (The Septième, the seventh partial, clashes with the notes of the equally tempered scale; its inclusion in a chorus would have been characteristic of the French Romantic organ, but not elsewhere.)

The Italian organ found its basic tone palette during the Renaissance, and used the simple system of intervals to designate the component of the Principale 8' chorus (British builders used this method as well): Ottava 4 (Octave); Quintadecima 2 (Fifteenth); Decimanona 1-1/3 (Nineteenth); Vigesimaseconda 1 (Twenty-second); Vigesimasesta 2/3 (Twenty-sixth); Vigesimanona 1/2' (Twenty-ninth); Trigesimaterza 1/3' (Thirty-third); and Trigesimasesta 1/4 (Thirty-sixth). The RIPIENO, as the Prinzipale chorus was called, remained the basis of the Italian organ well into the nineteenth century. The preponderance of one-manual organs and virtual absence of reeds left the relatively few Flute stops with solo stop status, even in late nineteenth-century organs.

RICHARD KASSEL

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PROGRESSIO HARMONICA

A Mixture stop in which the ranks increase in number as the notes progress from bass to treble. It was invented by F. Wilke of Neu-Ruppin, Germany, as a means of reinforcing the treble. The original Progressio Harmonica started with two ranks, 1-1/3' and 1', and added a third 2' rank at tenor C.

See also **Compensating Mixture; Stop**

EDWARD L. STAUFF

PRUSSIA

SEE EAST PRUSSIA; POLAND; SILESIA

PULL-DOWN

(1) Generally, a motion within a tracker ACTION in which a direct connection between KEY and WINDCHEST pallet is effected by a wire or fabric string that passes through an opening in the bottom pallet box. Pressing the key down pulls the wire, in turn pulling the pallet down so that wind might enter any open pipe. (This is an early form of suspended mechanical action.) In Romantic and postromantic pneumatic action organs, pull-down purses were used in the operation of secondary motors within the action. Electro-pneumatics added the magnetic element to the pull-down motor, as seen in KEY CHANNEL technologies and PITMAN CHEST purses.

(2) An early form of COUPLER, in use before the PEDAL had its own division and ranks. The pull-down (wire or fabric string) connected the pedals to the keys of the lowest notes of the keyboard and functioned like a TRACKER; when a pedal lever was depressed, the attached key would follow suit, and that note would play. In late medieval and Renaissance instruments (and in some national organ styles, into the late eighteenth century), this allowed (at first) the sustaining of long cantus firmus notes or drones, then individual lines (often a chorale, hymn, or chant melody) or bass parts. Once it became possible to create a separate Pedal DIVISION, builders in Germany and elsewhere switched to this design, thus freeing all manuals from having to allocate stops for the "needs" of the pull-down.

As pallets were aligned vertically with their corresponding keys and pedals, POSITIVES and other small organs could be controlled by pull-downs directly. As instruments grew in size, and keys could no longer be placed immediately under their pallets, their action had to be transferred horizontally to the appropriate windchest, leading to the invention of the ROLLERBOARD. Eventually the pull-down mechanism was superseded by the trackers, stickers, and backfalls needed for increasingly sophisticated action and windchest technologies.

In the revival of tracker actions since World War II, the pull-down has been reserved for newly built positives and smaller HOUSE ORGANS; although an "authentic" technology, it has nonetheless become genuinely antiquated, and is not found in larger neoclassical revival instruments.

Richard Kassel

PURCHASING AN ORGAN

The purchase of a new pipe organ is the commissioning of monumental art. An instrument is designed specifically for the room that will house it, creating an architectural design that complements the surroundings and a tonal design appropriate to the scale of room and the musical requirements of the institution. Modern instruments are often designed to be eclectic in their musical capabilities, allowing many different styles of music to be played. In some circumstances (especially educational settings), organs are built to be closely modeled on a specific style, creating an instrument particularly well suited for a single style of music. Organ builders often collaborate with acoustical consultants, structural engineers, and architects to create an environment that provides the organ with a stable climate and physical support.

It is typical for an institution planning to purchase an organ (e.g., a church, school, or concert hall) to assemble a committee to study the situation and available possibilities, traveling to visit the workshops of various organbuilders and the instruments they produce. Because of the great expense of constructing a new instrument it is typical for the parties involved to negotiate and sign a detailed contract describing the scope and specifications of the organ, schedule of payments, and schedule of delivery. Purchasing institutions are well-advised to consider artistic qualities before price—the success of a new organ is measured by its musical and visual impact.

The American Guild of Organists, the American Institute of Organbuilders, the Associated Pipe Organ Builders of America, and the Organ Historical Society all publish materials that offer guidance in the planning of a new organ.

See also **Organizations**

John Bishop

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PYTHAGOREAN COMMA

In tuning theory, the amount by which six Pythagorean whole tones (each being the difference between a pure perfect fifth and a pure perfect fourth) exceeds an octave. The frequency ration for the Pythagorean whole tone is 3:2 - 4:3 = 3:2 x 3:4 = 9:8; hence the ratio for the Pythagorean comma is $(9:8)^6$ - 2:1 = 3^{12} - 2^{19} = 53144:524288. This amounts to 23.45 cents (about an eighth of a whole tone). Also called the ditonic COMMA.

See also **Tuning and Temperament**

PYTHAGOREAN INTONATION

Tuning by untempered fifths (with the ratio 3:2). The music in the oldest known manuscript of keyboard music (the Robertsbridge fragment, first half of the fourteenth century) appears to call for a chain of eleven such fifths from E-♭ to G-♯ (thus, twelve notes per octave). There is some degree of corroboration in two contemporary treatises (by Walter Odington and Hugo Spechtshart) that prescribe a chain of ten fifths for E-♭ to C-♯. However, most of the fifteenth-century treatises that deal with such matters put the chromatic notes in a chain of (untempered) fifths with F. A number of early- to mid-fifteenth-century keyboard pieces, most of them probably for clavichord since they are transcriptions of songs, sound uniquely well in such a tuning, which is also to be inferred from measurements taken from the intarsia representation of a fretted clavichord in the *studiolo* of the ducal palace in Urbino, Italy (ca. 1480).

See also **Tuning and Temperament**

Mark Lindley

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Q

QUARTANE

See Rauschpfeife/Rauschquinte/Quartane

QUARTER-COMMA MEANTONE TEMPERAMENT

See Meantone Temperament; Tuning and Temperament

QUEMAR (FULGENZI), VINCENZO

See Fulgenzi, Vincenzo

QUINT

The term *Quint* has two applications. The first is—from the late Renaissance on—as a metal or wood Diapason foundation stop, sounding at the fifth between the unison and octave stops at any register; on the manuals, 5-1/3' between 8' (unison) and 4' (octave); on the pedal, 10-2/3' between 16' and 8'. There is no such tone in the overtone series; Quint has nothing to do with the fifth partial (a 17th above the fundamental). The term *Quint* is at times extended to include similarly related ranks at other registers, both on manuals and pedal, but this is not a strict definition.

The second application is as a pipe that, when added to a "unison pipe" a fifth below, produces an audible "difference tone" (resultant) an octave below that unison. For example, C + G (Quint) = G – C = CC (resultant). This mutation stop produces sufficient if not wholly genuine bass notes on smaller instruments.

See also **Resultant/Acoustic Bass/Gravissima; Stop**

QUINTATEN/QUINTADENA/ QUINTATON/QUINTADE

A narrow-scaled stopped metal pipe, blown forcefully enough to emphasize the twelfth (third partial); the stop itself is relatively soft. The various names refer to the emphasized fifth, as it is perceived in the total harmonic content of the stop. The stop dates from at least the Renaissance; some associate its sound with that of a Stopped Diapason.

R

RACKBOARD

A perforated, usually wooden rack, located above the toe board and resting on wooden pillars or other means of support. It serves to hold a group of pipes in place, preventing dislodging and inhibiting shaking as the airstream rises past a pipe's mouth, into the resonator and out the top. The rackboard is usually located between the toe hole and the mouth, closer to the latter. Some older Mediterranean instruments place it above the mouths; the rackboard itself may be made of stiff leather. In older instruments where the rackboard is no longer able to secure pipes in their places firmly, a modern version of the device is employed, usually constructed below the rackboard and using wood or metal, and called sky racking.

Richard Kassel

RANGE

The actual pitches that can be played or sung by a particular instrument or voice; on an organ, it is expressed by its lowest and highest notes, with missing notes indicated (such as in the short octave). On an organ, the compass of a keyboard is fixed; the available range at any given moment depends wholly on the registration in effect (16', 8', 4', divided stops, etc.).

RANK

A row of pipes of the same stop type (shared construction, tone color, register) and arranged on a windchest so that there is one pipe for each note played on the keyboard or pedalboard connected to it. The size of an instrument is described by the number of manuals and ranks it possesses. While a rank is controlled by a single slider, drawstop, on-off switch, or piston, a stop may involve more than one rank, as is found mostly in compound stops and mixtures. Duplexing and other borrowing mechanisms allow stops to utilize pipes in a rank other than their own. In seventeenth-century British organ terminology, a rank was a pipe row or grouping that made up a compound stop, a term now generalized to "stop."

Richard Kassel

RANKET(T)

A reed stop of the regal class, usually found at 16′ pitch, but occasionally at 8'. While it has been made with a variety of resonator shapes, these are always short, and usually capped with holes in the side or bottom, resulting in a gentle, muffled tone. The Ranket dates from the end of the sixteenth century, and is named after the instrument, an early double reed instrument of subdued tone.

See also **Stop**

Edward L. Stauff

RAPHAËLIS, HERMANN

See Rodensteen

RAUSCHPFEIFE/RAUSCHQUINTE/QUARTANE

(From Ger. *rauschen*, to rustle.) A compound stop of two unbroken open metal ranks at 2’ and 1-1/3’ pitch, sometimes with a third 2-2/3’ rank added. The organ stop dates from the late sixteenth century, and may have been named after the instrument, a pre-Baroque wind instrument, having a capped reed and loud tone. A few sources equate this stop with the Rauschquinte, but most sources distinguish between them, defining the Rauschquinte as being composed of ranks at 2' and 2-2/3' pitch or at 1' and 1-1/3'. The synonym Quartane derives from the interval of a fourth that stands between those two pitches.

See also **Stop**

EDWARD L. STAUFF

RAVALEMENT

SEE KEYBOARD

RECALDE, LOPE ALBERDI

SEE ALBERDI RECALDE, LOPE

RÉCIT

A manual DIVISION existing in the French organ from the early 1600s. (The term also serves as a designation for a solo melodic line in French classical organ literature.) Originally, the keyboard played the MOUNTED Cornet was played from the GRAND ORGUE windchest (Paris, St.-Séverin, 1610). Parisian builders in the 1630s tentatively provided separate pipework and action for the Récit manual, thus separating it from the Grand Orgue. Another approach, common after 1645 and often practiced by Pierre THIERRY, consisted of alternating Récit and Grand Orgue grooves in the main chest, allowing certain stops to be borrowed from the Grand Orgue to the Récit. Composers, however, paid little attention to such anomalies and consistently restricted their registration to the Cornet séparé (a Cornet of the Récit manual with its own wind supply from the Grand Orgue), but builders occasionally extended it downward to g or f. Throughout the evolution of the classical French organ, the Récit invariably retained its Cornet function, but post-classical builders enriched the manual with a Trompette favored earlier by LeBègue. François-Henri CLIQUOT provided his Récit divisions at Paris, St.-Sulpice (1781) and at Poitiers, Cathedral of St. Pierre (1790) with a Cornet V, Trompette, Hautbois, and Flute 8’. His smaller instrument at Souvigny included a Cornet IV, Hautbois, and Bourdon 8’, isolating the 8’ rank of the Cornet on a separate SLIDER.

In the nineteenth century, the Récit manual was provided with a SWLL box as early as 1827 (Hamel organ, Beauvais, Cathédrale St-Pierre). Aristide CAVIAELLÉ-COLL’s first instruments were so equipped. Although the English builder JOHN ABBEY is frequently credited with introducing the swell box to France, Cavaillé-Coll may have first learned of the swell box in Spain, where he often worked with his father before moving to Paris in 1833. The Récit compass, however, only gradually descended toward C. Before 1850, a compass of between thirty-seven and forty-three notes was not uncommon; Cavaillé-Coll’s first instrument (Notre Dame de Lorette, Paris, 1838) was provided with only a thirty-seven-note compass on that manual. However, his first significant organ, at St. Denis (1841), boasted a full-compass Récit (fifty-four notes, C-f´´´). Subsequently, instruments of any importance were given the same compass as the other manuals, although his organs for smaller parishes were sometimes given a shorter compass (Ste.-Pourçaine, 1861; St.-Maclou, Pontoise, 1877).

The specification of the nineteenth-century Récit reflects its classical origin. Solo reeds such as the Trompette and Hautbois retained their positions on the Récit, as did the Cornet in many cases. A pyramid of harmonic flutes (Flûte Traversière or Harmonique 8’, Flûte Octaviante 4’, Octavin 2’) was placed there as early as Cavaillé-Coll’s organ in Notre-Dame de Lorette, Paris (1838). The Viole de Gambe became commonplace after 1846, but the register called Voix Céleste was often a wide-scaled atop until almost 1870 intended to undulate with another wide-scaled stop. The Voix Humaine was moved to the Récit from its previous position on the Grand Orgue. Although the Récit division evolved considerably during the more than sixty-year career of Cavaillé-Coll, only in the rarest of instances was anything close to a PLENUM introduced on this manual. Late instruments (following Cavaillé-Coll’s work in England in the 1870s) often include a Diapason 8’ to complete the foundation chorus, but Prestants, Doublettes, and Mixtures were rare; St.-Sulpice, Paris (1862) and Lisieux (1874) must be considered exceptional. Late-period instruments (ca.1875–1900), however, do occasionally employ the Carillon stops (Trocadéro, 1878; St.-Ouen, 1890). During this time, a 16’ flue (often a Quintaton) and 16’ reed (often a Bombarde) became commonplace, thus establishing the “French Swell.”

Beginning with Charles MUTIN, Récits often included a PLEIN JEU stop, frequently crowning the aforementioned Flute pyramid, rather than a plenum. With the development of the neoclassical French organ in the work of Victor GONZALES, a full plenum was established conclusively on the Récit. Unlike the Grand Orgue or Positif (POSITIV) division, which underwent significant metamorphosis at the hands of the neoclassical builders, the Récit (other than the introduction of mixtures) was left by and large intact: flutes (stopped and open), strings, Principals and Mixtures, Cornet or Sesquialtera, a chorus of reeds (16.8.4), Hautbois, and Voix Humaine.

Jesse E. Eschbach

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RECORDING TECHNIQUES

No single instrument presents more complications in making satisfactory recordings than the organ does. In this regard, the organ resembles the symphony orchestra; on one hand, there is the desire to capture the multiple distinctive "voices" present; on the other, the effects of room ambience are crucial to the listening experience. A further difficulty in recording the instrument is its need for on-site recording. While large recording studios and many concert halls have considerable experience in recording orchestras, most important organs reside in churches. Not only are recordings usually less frequent in those spaces, but ecclesiastical priorities rarely include sophisticated recording equipment. Most organ recordings are the result of moving microphones and recording equipment from site to site; if the space is unfamiliar, a considerable amount of experimentation may be needed; and no concert hall presents the challenges that a reverberant place of worship presents. But it is a challenge that has been met with different degrees of success since World War I and especially since the development of the long-playing record, around 1950.

In the 1920s, Thomas Edison was an important producer of organ recordings in the United States, beginning with acoustic (mechanical) recording, in which the sound was picked up by a "horn," which used a diaphragm and an attached sapphire cutter to cut directly onto a master cylinder, later a flat disc). Later, Edison followed in the footsteps of other companies (e.g., Victor, Columbia) and made the switch (1927) to electric recording, invented by AT&T, by which newly invented microphones, preamplifiers, and amplifiers increased the reproducible sound range and improved fidelity, eliminating the "faraway" sound of acoustic recordings. While Edison ended his recording activities just before the Depression, Victor, Columbia, and other companies continued with the new technology, which persisted until tape recording became commercially viable after World War II.

The first organ repertoire on records relied on popular music and arrangements; organists also made recordings with singers. Theater organs had the advantage of residing in relatively nonreverberant rooms, making them easier to record than church instruments. Because of the time limitation on a 78-rpm disc (about four minutes per 12" side), commercial classical recordings were limited to "lollipops" like Camille Saint-Saëns's *Danse Macabre* or lighter works by Johann Sebastian Bach. French organist-composers (Tournemire, Vierne, Widor) made a number of recordings late in their careers; Maurice Duruflé's and Olivier Messiaen's earliest recordings came at the tail end of the 78 era. But perhaps the most significant organ 78s were Albert Schweitzer's Bach recordings, made in England in 1935–36. However dated the recordings may sound now, they had behind them the weight of the Organ Reform Movement and the outstanding reputation of the polyglot Schweitzer.

In the early 1950s, the invention of the lighter and less fragile LP coincided with the commercialization of recording tape, the indirect result of experimentation with wire recording during World War II. The immediate benefit was the availability of longer continuous performances on a record side (twenty minutes at first, later increased by microgroove technology) and even longer performances on recording tape. The latter introduced the notion of editing, long a characteristic of film, so that a "recorded performance" could comprise snippets of several takes spliced together. This introduced a new tension between live performance (when human error was almost inevitable) and recorded performance (where every effort was made to achieve "perfection"), although live performances continued (and continue) to be recorded and released commercially (although in the digital era these can be "touched up" afterward).

Finally, the recording process itself was revolutionized by the possibilities of stereo reproduction and (later) multitrack recording. For any musical performance, this allowed for the spatial separation of sound and sharper definition of timbre. For the organ, the issue of direct versus ambient sound inevitably came to a head: What was more important, the sound coming out of the pipes, or the sound heard in the room (i.e., church)? Could a balanced mixture of the two be accommodated? Even experiments in quadraphonic reproduction did not ease what will no doubt remain a question of taste and preference rather than a problem with one solution.

Recording techniques evolved dramatically over the last third of the twentieth century: (1) the variety and capacity of microphones, and the freedom to place them anywhere, from in front of the chests, to above the case, to locations throughout the room; (2) the development of ever more sophisticated recording equipment such as analog (linear) systems, mixing boards, and sound processing (e.g., equalization and noise reduction); and (3) the introduction of computer technology, leading to the (nonlinear) digitalization of sound "information." The digital recording became the industry standard, notable for clean and sharply defined sound, frequency, and dynamic range (essential for an instrument whose registration can range from 64' to 1/6'), limited only by the microphones used and the possibilities of numerically based editing. The development of the compact disc (and other technologies) to reproduce digital information as sound completed the transition; now the results were limited only by the speakers used.

What was the response of the recording industry in terms of the organ? As in all musical fields, live performance became a way to sell records; the concert tour took on new meaning. Organists emphasized different repertoires and approaches: Helmut Walcha and the German school earnestly emphasizing Bach above all else; E. Power BIGGS recording a more varied repertoire on as many European (and American) organs as possible, with an increasing eye toward "authentic" instruments; populists like Virgil Fox applying the Romantic sound to an organist-as-showman presentation; and Messiaen leaving the legacy of his entire output in his own "definitive" recordings.

The recording of organ music has become a cottage industry; as an increasing number of historical instruments are brought back to life, the desire to record them is insatiable. The recorded repertoire has expanded by leaps and bounds, exploring everything from the first extant works (fourteenth century) to the latest experimental pieces (and the usually more conservative works of organist-composers). Besides the ubiquitous composer- and repertoire-driven approaches, organists can choose between a single instrument, organs from one region or by one builder or of one type (or a comparison between examples of each), or by a school of organist-composers (ideally on the instruments they played, or something similar).

In opposition to the traditional instrument and its recording apparatus, the development of the fully electric organ and the more recent invention of MIDI (musical instrument digital interface) technology have meant that a keyboard with no wood nor piping can take sampled sounds from acoustic instruments and create something like the original, with the "advantage" that recording is a digital process conducted over wiring, not an analog process subject to ambient sound and traditional organ phenomena like chiff and noisy pallets. Compositional elements may also enter by way of transforming the aural output into other sounds.

What is gained by this is lost as well, however: If the desire is to reproduce the effect of a traditional organ using electronics and MIDI, elements like reverberation, blending, and spatial relationships must be programmed into the process, an irony of high order. So the primary focus of organ recording (and experimentation thereof) has become the merging of digital technology (minus MIDI and using electricity, but not electronics except as a last resort) with the traditional instrument to produce the performer's or other decision maker's notion of the "truest sound," however different this is from one set of ears to another. There are those who feel that the ear does not hear "numerically"; digital recording should, according to these individuals, be replaced by its predecessor in the form of analog recording, mixing, and (even) listening medium (i.e., LPs rather than CDs), unprocessed, and with as few microphones as possible.

RICHARD KASSEL

REDMAN, ROY A. (B. 1938)

American organbuilder. He became interested in music at an early age, studied several instruments, and graduated from North Texas State University in Denton, with a B.A. degree in music. He also holds divinity and sacred music degrees from Southern Methodist University. After serving seven years as a full-time minister of music in the United Methodist Church, he founded Redman Organ Company in 1966. He is in the forefront of the movement to preserve valuable old instruments; by 1992, Redman Organ Company had completed sixty-one new, rebuilt, and restored organs. Redman is also a founding member of the American Institute of Organbuilders, and the firm is a member of Associated Pipe Organ Builders of America and the International Society of Organ Builders.

REDSTONE, WILLIAM (CA. 1768–1824)

American organbuilder, born in England. An advertisement in the *Connecticut Herald* (New Haven, CT) of 18 February 1817 states that Redstone had been building organs for forty years. Between 1810 and 1824, he was active in New York, and at least two of his sons, Thomas Redstone (1790?–1850) and Henry Redstone (1793?–1816), assisted him. Redstone's largest organs (all in New York State) were built for Albany, St. Peter's Episcopal (1812), Schenectady, St. George's Episcopal (1812), and Brooklyn, St. Ann's Episcopal (1814?). He died in New York City on 26 February 1824. Surviving descriptions of his instruments suggest that they were in the typical English style, usually one manual without a pedalboard. The only extant Redstone organ is located at Geneva, New York, Trinity Episcopal Church, (rest. Tattershall).

STEPHEN L. PINEL

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REED

One of the two classifications of pipes in the traditional organ, also called LINGUAL; the other is the FLUE, also called LABIAL. A flue pipe is a solid piece of wood or metal, without moving parts; its sounds are produced like a sophisticated whistle. The reed pipe, more likely made of metal than wood, substitutes a BOOT for the flue pipe's FOOT, with an open bore (TOE hole) receiving wind from below to produce sound.

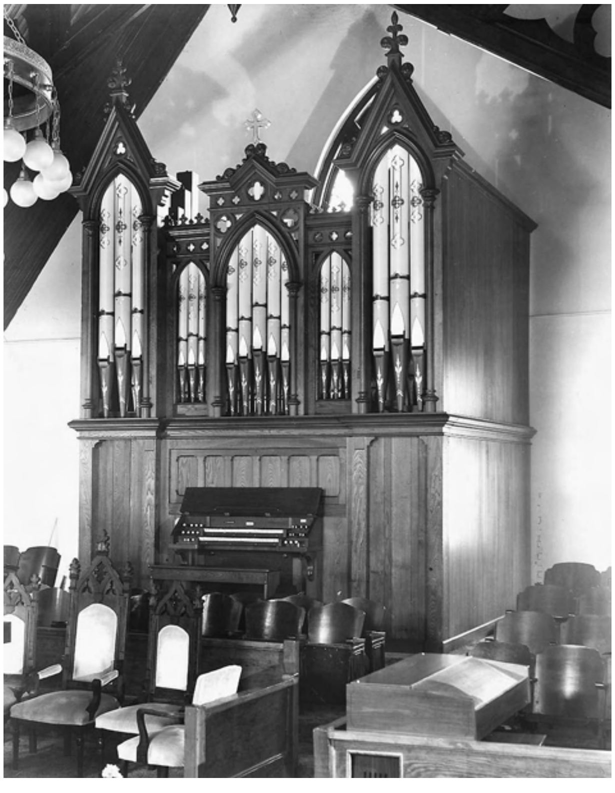

Fig. 64. Redman restoration (1977) of Hook & Hastings organ, Op. 647, 1872 (2/16), Reedy Chapel AME Church, Galveston, Texas.

However, the boot contains within it the sound-making mechanism of the reed pipe. The SHALLOT, a brass tube with a flattened closed side, has an aperture against which a metal tongue vibrates rapidly when wind reaches it, producing a pitch. (This type of pipe is called a striking or beating reed, as opposed to the FREE REED or DIAPHONE.) The shallot is attached at its top to a block, from which the reed's RESONATOR rises; a hole in the top of the shallot opens into the resonator and allows the vibrating air to continue to the pipe's top. The pitches sounded by the shallot and tongue assembly and reflected by the air vibrating within the resonator are tuned to approximate but not identical frequencies; the sound is then projected fully into the listening space. A small wooden wedge holds the shallot securely in place at the bottom of the block, allowing for uninhibited but controlled tongue vibration. A small piece of metal (tuning wire), operated from above the block, allows the length of the tongue to be changed, thus fine-tuning the pipe's pitch; voicing techniques at the top of the resonator may also be applied if necessary.

The reed pipe's resonator not only determines pitch to a significant degree; its shape may have a considerable impact on the tone quality. The shape may be cylindrical, conical, or a combination of cylindrical, conical, or inverted conical shapes. Adjustments to the shallot and tongue can affect the harmonic content (partials) of the sonority; resonator length relative to the equivalent flue pipe may be a determinant as well. With so many options for construction, reed stops tend to be more distinctive and "louder" than flue stops, in part because their harmonic content is more subject to manipulation.

Reed stops are subdivided into solo stops and chorus stops; most can be found in any division. The first group (CLARINET, KRUMMHORN, ENGLISH HORN/COR ANGLAIS) are often used for melodic lines, to the accompaniment of flue choruses. Chorus reeds are more likely to add character and support a flue chorus; these include TRUMPET/TROMPETTE, CLAIRON/CLARION, CORNOPEAN, and BOMBARDE. The OBOE/HAUTBOIS may serve as a solo or chorus stop; the TROMBONE/POSAUNE usually functions as a chorus reed in the Pedal only. The French Romantic organ featured the ANCHES, a reed chorus ensemble with added flue and mixture stops.

RICHARD KASSEL

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REED ORGAN

A KEYBOARD instrument, belonging to the general class of aerophones (wind instruments), employing non-beating FREE REED tongues as a sound source, and thereby distinguishable from the REGAL. The free-reed principle has a long musical history, but free-reed keyboard instruments did not appear until the late eighteenth and early nineteenth centuries, when free reeds as a sound source were experimented with by organbuilders and incorporated into the pipe organ, CLAVIORGANUM, and self-playing instruments such as Johann Nepomuk Maelzel's panharmonicon, a type of ORCHESTRION. This initial interest was probably prompted by the space-saving propensity of free reeds, but after the opening of the nineteenth century interest shifted to their unique tonal characteristics and ability to retain their tuning.

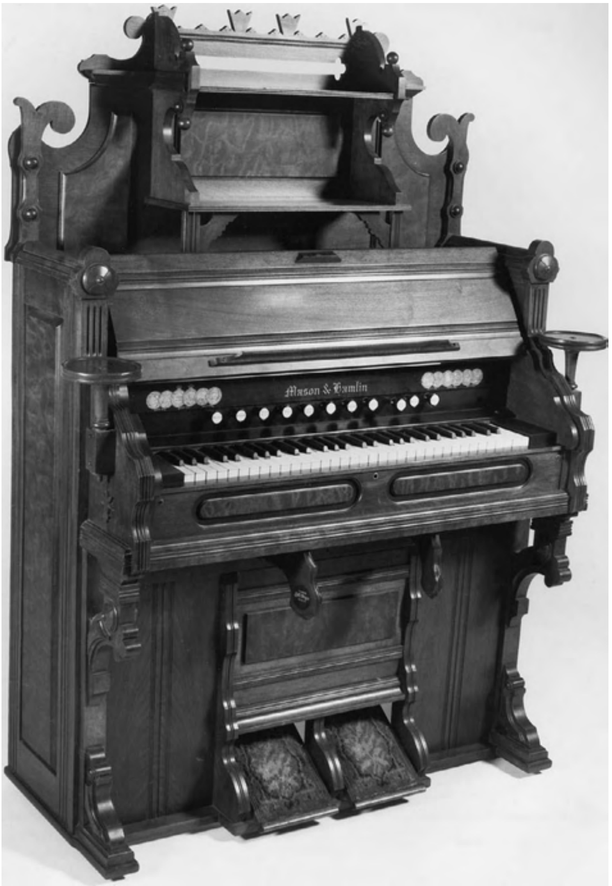

Fig. 65. Mason & Hamlin parlor organ (Photo courtesy Arthur W. J. G. Ord-Hume, The Library of Mechanical Music & Horology).

Early experimentation with free-reed keyboard instruments, under various, often fanciful names, occurred almost simultaneously in several countries. J. C. Schlimbach and J. H. Förstner of Germany made such instruments independently around 1810, Schlimbach naming his the Aeoline. At about the same time Boston organbuilder Ebenezer GOODRICH made a small reed organ said to have been inspired by the Chinese *shêng*; Gabriel-Joseph GRENIÉ of Bordeaux made a free-reed instrument with resonators that he called the *orgue expressif*. Much development occurred during the next three decades, by the end of which the basic principles of the reed organ had been largely established. In England, Charles WHEATSTONE patented his Aeolina in 1828; in 1830, John Green built a similar instrument called the Royal SERAPHINE, for which he also wrote the first known reed organ tutor. In the same year the French organbuilder Aristide CAVAILLÉ-COLL made the precursor of the standard French harmonium, the *poïkilorgue*. By the 1840s reed organ production was well under way on both sides of the Atlantic.

Two methods of WINDING the reed organ emerged at this time. American makers such as Jeremiah CARHART and George A. PRINCE had adopted a suction system of winding, as did the later giants of the reed organ industry, ESTEY, MASON AND HAMLIN, and W. W. KIMBALL. In Europe the pressure system was widely adopted by manufacturers such as ALEXANDRE and Mustel in France and Schiedmayer in Germany. This difference seems to have influenced the musical use of the instrument on both continents. The suction system facilitated ease of playing at the expense of expressiveness; the pressure system allowed for expression, but the instrument was more difficult to play properly. Thus, in the United States and Canada, the reed organ remained largely an amateur's instrument, although often used also in small churches. In Europe, reed organs were similarly used in homes and churches, but by the second half of the nineteenth century harmonium courses were being taught in conservatories, concerts were being given on large harmoniums, and mainstream composers such as César Franck, Sigfrid Karg-Elert, and Louis Vierne were writing serious music for it.

The second half of the nineteenth century can be considered the "reed organ era." Mass-production techniques were applied to their manufacture, especially in the United States, where by the early twentieth century the Kimball firm boasted having built over 400,000 reed organs. Although the basic mid-nineteenth-century reed organ was small—shaped like a miniature square piano, or "flat-topped," as in the so-called melodeon—many variants on this model later appeared, from ornate Victorian home models with mirrors and bric-a-brac shelves and MASON AND HAMLIN's portable "Baby" organ to large two-manual-and-pedal church instruments such as James BAILLIE-HAMILTON's VOCALION, popular toward the end of the nineteenth century and almost the only pressure-principle reed organ to be made in America. (There was even a self-playing reed organ, the ÆOLIAN COMPANY's ornate Orchestrelle, based on the Vocalion.) European developments concentrated more on musical effects, such as sustaining devices, percussions, undulating stops, and devices for procuring greater expressiveness.

Another development, oddly prophetic of electronic chord organs of the post–World War II era, was the creation of a boxlike device, to be placed on top of the keyboard, that played chords when buttons were pushed on the box. The buttons were numbered, with no indication of pitch names. The earliest documented device, the Harmoniphone Transpositeur, was credited to one Abbé Lambilotte and introduced by ALEXANDRE at the 1851 Crystal Palace Exhibition in London; it had thirty-eight buttons, and required that four buttons be pushed to produce a chord. Later devices were designed to produce chords with only one depressed button, with available sheet music. Some devices were built into a harmonium; others used a slide to allow transposition. Such devices included the Harmonista, Liebmannista, Koralion, and Organola.

The popularity of the reed organ declined in the early years of the twentieth century, replaced domestically by inexpensive mass-produced upright pianos and in churches by small "stock" pipe organs. Nonetheless, reed organs continued to be made, especially in Japan and India; in the latter country, the harmonium has virtually become a folk instrument. In the United States, the Estey firm, which had branched out into pipe organs, briefly marketed an electronically amplified reed organ during the 1950s, after which it may be said that reed organ making ceased in North America. During the 1970s and '80s a revival of interest in the reed organ occurred, resulting in the formation of the Reed Organ Society, an international organization. Reed organs are now being restored and collected, perhaps the most notable collection being the Victorian Reed Organ and Harmonium Museum in Saltaire Village, Yorkshire, England.

See also **Free Reed**

BARBARA OWEN

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REGAL (I)

A small organ in which the tones were produced from REEDS; when pipes were used, they were made of metal, wood, or varnished paper, but they were not essential to the instrument. Popular from around 1450 to 1750, it was valued for its ability to accompany voices, thanks to its continuous tone, which gave better support to singers than a plucked keyboard (harpsichord) would. The regal (or regals) employed beating reeds under pressure, the tongues of which struck and thus covered a slot in the side of the tube or SHALLOT, as in the modern pipe or clarinet. This differs from free reeds employed in modern REED ORGANS, which have tongues that pass through the slot in vibration instead of striking it, producing a smoother tone.

The regal consisted of a WINDCHEST, on one side of which was a KEYBOARD; on the opposite side, two WEDGE BELLOWS were operated by an assistant (similar to a POSITIVE). Short pipes were placed on top of the windchest with the reeds in their lower ends. The pipes themselves were of varying lengths and affected timbre exclusively, the pitch depending solely on the reeds. The pipes could be open, stopped, half-covered, and sometimes provided with small holes in the sides to produce different tonal qualities. Metal pipes were most often made of copper or brass. Ranks were controlled by stops, and the keyboard sometimes divided, with pitches available at 16', 8', 4', and 2' levels. The regal held its pitch and tuning better than organs with flue stops because the metal reeds produced the pitches, not the pipes, and thus were only marginally affected by changes in temperature and humidity.

Around the mid-fifteenth century, George Voll, a Nürnberg instrument maker, built a regal in which the various external parts of the instrument could fold in such a manner as to take the form of a large book, and thus was called the "Bible regal." Such instruments were used in Germany to accompany small choirs to the beginning of the nineteenth century. However, Voll did not invent the regal, as once thought.

In his *L'art du facteur d'orgues*, François BÉDOS DE CELLES gives a description "of an organ in a common table." The instrument outwardly resembles a melodeon with legs and has a keyboard range of four octaves, beginning on F. The single BELLOWS is below the instrument with a RESERVOIR opposite it on top, and is pumped by the player by means of a foot PEDAL that communicates with the bellows by means of a pulley-and-cord arrangement. The top must be open when playing because of the expansion of the reservoir. There are no pipes or tubes, and the tones are produced solely by the reeds, which are set in blocks and are placed at the back of a cell, one of which is provided for each reed and key. The reeds are controlled by a rod passing from the key above to a valve placed below the reed, a form of pin ACTION. A similar instrument with two manuals is described later in the treatise.

While this instrument is called an organ by Bédos de Celles and not a regal, it seems obvious by its construction that it belongs to this class. The author implies that it is not intended for concerts, but for a gracious amusement in a room, and has the advantage of being easily moved by one person.

See also **Reed Organ**

JAMES HOWARD RICHARDS

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REGAL (II)

(1) An early reed stop type, characterized by shorter than usual resonators, often of unusual shape. The name was applied by Arnolt Schlick and others to early reed stops that presumably resembled the keyboard instrument of that name, a small beating-reed organ from the early Renaissance with direct-pin action, small resonators, and wedge bellows (see REGAL I). François BÉDOS DE CELLES refers to a Régale as the earliest reed stop, intended for the manuals and entirely without resonator, but no longer used in church organs once other, more subtle reeds were developed in the Renaissance. He states that a small cone was fitted to slide on top in order to increase volume.

The term came to apply (at times ambiguously) to a wide range of reed stops with a variety of timbres and shapes. However, because the resonators are less than unison length, the pipes do not support their fundamental and lower partials. This emphasis on higher partials is physically analogous to the nasal and buccal production of sound; especially noteworthy is the unpredictability of emphasis among those upper partials, depending on the particular stop and acoustic environment. Regals tend toward breathiness, yet possess a "twangy sound" that enhances the transients as sounds die away.

Regals function in combination to accent, not blend colors, carrying melody and counterpoint effectively, distinguishing themselves timbrally from the more common flue and reed stops by sounds described by Irwin as a "snarl, growl, sigh [or] acid whine. . . . [They can] glitter with metallic brilliance [or] give a percussive tinkle" at the outset. In northern Europe, especially Germany between 1575 and 1700, there were many experiments with Regal pipes and resonators; the results included the Apfelregal ("apple-shaped," with a perforated ball at the top), BÄRPFEIFE, Jungfernregal ("maiden's voice"), Kopfregal ("head-shaped"), PHYSHARMONIKA, and Trichterregal ("funnel-shaped"). The Regal concept was also applied to stops emulative of other instruments: bagpipe, brass, harp, krummhorn, racket, shawm, trumpet, and strings. Regal stops were reconstituted for neobaroque instruments in the twentieth century.

(2) A division of regal stops occasionally found in organs between 1575 and 1700; in Germany, such a division was often called a *Schnarrwerk* (Ger. *schnarren*, to buzz). Often a Regal division was incorporated under more common names, such as the BRUSTWERK or UNTERWERK.

See also **Stop**

RICHARD KASSEL

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REGISTERKANZELLENLADE

See Windchest

REGISTRATION

The selection and adjustment of organ stops for performance. Each instrument has a STOPLIST of available sonorities from which an organist may choose. The performer will think in terms of appropriateness of historical style (making Johann Sebastian Bach *sound like* Johann Sebastian Bach, as it were); location of stops on different manuals and the PEDALBOARD; and available combination actions and other devices to executed mid-piece changes easily. Another consideration is the nature of the performance itself: solo, liturgical accompaniment of congregational singing (and, in most cases, interludes at certain points of the service), or as a concerto soloist or integrated orchestral instrument.

The simplicity of the definition belies the complexity of the subject. For one thing, registration has followed (or reacted to) the instrument's evolution. Once the invention of the SLIDER made the separation of individual stops possible, organbuilders had incentive to play with existing pipes to create new sounds (and stops). This process did not cease until the early twentieth century and the heyday of the UNIT ORGAN. The ORGAN REFORM MOVEMENT was, in effect, a radically conservative (and perhaps elitist) reaction to the ultimate in registration possibilities: the electrically powered post-Romantic organ, as "showy" and "populist" as any other cultural symbol, embodied in the THEATER ORGAN. The twentieth century saw two patterns emerge: (1) the eclectic organ, an all-purpose instrument that contained the elements of several styles (e.g., the American classic organ); and (2) the devolution toward Baroque/classical stoplists. The latter process began with the creation of historically accurate stoplists, but by 1970 it was understood that the pipes of surviving organs had to be studied closely and imitated (or re-created) also. The neoromantic aesthetic of the late twentieth century should be more easily realized, given the survival of so many more nineteenth-century instruments.

The principles behind registration differ regionally and individually, but there was enough shared preference to create some standardization of stop choices. The most widely held concept was the full organ (Ger. *das volle Werk*, *die volle Orgel*; Lat. *plenum*, *organo pleno*; Fr. *grand jeu*, *plein jeu*; It. *per l'Organo pieno*). As Stauffer points out (*see* PLENUM), the plenum probably grew out of the BLOCKWERK, an inseparable collection of Principal ranks. The plenum does not imply the use of all available stops at once; rather, a PRINCIPAL chorus is complemented by mixtures and flue registers in the manuals, and the addition of PEDAL reeds. This concept was basic to most European organs and music to the end of the Baroque. Reports on improvisations by virtuosos mention the use of the plenum; Bach and other composers sometimes instruct performers to use the *organ pleno*. On occasion, builders had their own suggestions: for an instrument built in Fraureuth on the Saxon-Thuringian border (1742; 2/20), Gottfried SILBERMANN recommended the use of all available Principal stops, 8' and 4' Flute combinations on both manuals, a few mixtures, and a few 16' Pedal stops. Tierces are notable by their absence. The rest of Silbermann's recommendations involve solo combinations, some characteristic of his brother Andreas Silbermann's French-Alsatian practices, including JEU DE TIERCE/CORNET and NASARD combinations, a rare written description of the SESQUIALTERA, and a few combinations specific to these instruments, the SIFFLÖTE and Stahlspiel (CARILLON).

While many other national schools followed the plenum principle and allowed for individual organs and organists to determine couplings and combinations, the French classical school created a series of set registrations. By the eighteenth century, French composers were writing specific pieces for them, with the implication that a given registration would sound more or less the same on any French-built Baroque instrument. These included the GRAND CHOEUR, GRAND JEU, PETIT PLEIN JEU, and PLEIN JEU; composers were especially fond of writing Plein Jeu pieces. This approach to registration continued through the French Romantic era, with Franck and others specifying registrations to a detailed degree.

The Italian approach was already set by the Renaissance. Unlike the French organ, the one-manual Italian stoplist was dominated by the Prinzipale stops, with FLUTES and Voce Umana (VOX HUMANA) filling out the palette. Costanzo ANTEGNATI (*L'arte organica*, 1608) and Girolamo Diruta (*Seconda parte del transilvano*, 1609) each present registrational concepts. Antegnati matches various registrations to different genres (including the liturgical Elevation of the Host) and tempos, while Diruta associates each of the twelve modes (white-key scales starting from C up through A, with two different closing or "final notes" apiece) with a particular mood, from lamentation to liveliness).

The implied control that a central European composer-organist such as Bach had in his own performances was extended (idealistically) by French composer-organists to include any organist who tackled their music. Not only were instruments expected to be similar in sonority (and would re-create the composer's ideas "accurately"), but the instruments would remain more or less the same over time—an unrealistic belief, perhaps, given the usual tendency in organ building to evolve rapidly (until the twentieth century, at least). One suspects, however, that composer-organists everywhere have a fair idea of how their works should sound; post-Romantic composers have taken up the French approach, probably under the direction of a new work's first performer (as Johannes Brahms did with Joseph Joachim on Brahms's violin concerto).

See also **Anches; Fonds**

Richard Kassel

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REGULATOR

A device that controls (steadies) the pressurized flow of air between its source (BELLOWS, BLOWER) and its destination (TOE hole). The size of a particular pipe's FOOT (flue) or BOOT (reed) is crucial in regulating the amount of air that enters it, a factor that can be adjusted during the voicing of the pipe. However, the flow of air through the WINDTRUNK is independent of the toe hole and subject to gravity, conduit length, inertia, peaks and valleys of pressure and leaks, and the demands of the music itself. The term "regulator" is somewhat arbitrary semantically; it is usually not applied to the RESERVOIR, although the latter both stores and assists in the distribution of wind. On the other hand, at least one device labeled a regulator, the SCHWIMMER, may serve as a reservoir in some cases.

Every time a pipe is opened, there is a small drop in pressure; when the pipe opening is closed (by pallet or valve), there is a slight increase. In either case, the pressure returns to its normal level almost immediately. This phenomenon is known as "flexible wind" or "breathing," and was until the late nineteenth century the norm for sustained organ sound. (The historical and musical merits of flexible versus "steady" WINDING are discussed below.)

The greatest threat to consistent air pressure is the simultaneous opening and closing of pipes. The more pipes that open at once, the more air is drawn in, depleting the available supply. If the pipes are not sufficiently winded, there is an initial falloff in pitch before it rises to the correct levels. Analogously, the sudden restoration of air will cause a "bump" before returning to a normal pressure. The ultimate goal of regulation is to equalize the sound of related pipes and their pitch as much as possible, within the acoustic restraints of the room the organ is placed in.

As early as the twelfth century, THEOPHILUS described how the cuneiform bellows fed air through channels inside the conflatorium; each channel had a valve that opened when full and closed when emptied, preventing the wind from "kicking back" into the bellows. From this point on, regulation would take many forms, both as a function of windchests and related devices and as separate regulators introduced specifically to control wind.

In the late MEDIEVAL AND RENAISSANCE ORGAN, the basic regulating action was found in the pallet-and-groove WINDCHEST. Only when the appropriate key was pressed did the air leave the lower box through the now-open sprung pallet into the upper chamber (groove) before reaching and sounding open pipes (i.e., those not closed off by SLIDERS). Even as the windchest went through various changes between the thirteenth and eighteenth centuries (Blockwerk, sliderchest, spring-chest), the pallet and groove remained the primary means to regulate air flow.

The nineteenth century saw the addition of two regulators located near the windchest. The more significant, the schwimmer, was an airtight board, resting on the bottom of the windchest, that swelled and sank like a diaphragm as WIND PRESSURE required; springs provided resistance to its expansion. Because of its unusual position, the schwimmer expanded (as it filled with air) in a downward direction, unlike the bellows and reservoir, which were countered by springs. The CONCUSSION BELLOWS was an early passive pneumatic device in the path to the windchest. Excess wind fills the concussion bellows, closing the windchest entry; a depletion of wind closes the pneumatic, filling the windchest with air once again. Its primary purpose was to eliminate the "knock" that occurred when air pressures changed rapidly.

Other opportunities to reduce air pressure instability were placed at the point where air entered into the instrument. From the late medieval era, two or more WEDGE BELLOWS (*Spanbälge*) were operated in tandem; multifold bellows had the advantage of a more stable release of air into the windtrunk when compared to the singlefold device. The use of body weight to lower the folds was replaced by metal or stone weight, an important aid to the steadier release of air, although the bellows were still raised by hand lever. Variants such as the lantern bellows and box-bellows used pulleys to raise the top; weighted gravity was the most important factor in expelling air into the organ.

After experiments with sequential wedge bellows, the reservoir (also called "magazine" or "bellows reservoir") was developed as the first successful independent stabilizing device. The reservoir comprises a bottom frame and top lid, between which singly- or multiply-ribbed folds expand and contract. It rests on the wedge bellows and fills itself with wind directly. As the folds fall through gravity and weights, the air is expelled at a constant pressure into the windtrunk, aided by the alternation of inward and outward folds. The multiply ribbed PARALLEL RESERVOIR proved very successful, although a variant of the schwimmer (an airtight box, resting inside a larger box, rising and falling as wind pressure required) was occasionally employed as a reservoir. Eventually, the reservoir was provided with its own "exhaust valve" for those occasions when the pressure in the windtrunk threatened to push air back into the reservoir and even the bellows.

With this major step forward in terms of sending the wind to the windtrunk accomplished, more attention was placed on stabilizing the means of providing the wind. One such device, the manually operated rotary fan, upset those who saw one inhumanity—the pumping of feeder bellows—being replaced by another. The industrial age soon provided alternatives: wind generated by external water pressure, steam engines, electric feeder motors and, finally, the electric fan or blower. The steady stream of electrically-provided air requires a further check; no reservoir would survive the continuous blast of wind. One kind of regulator box expands on the pulley principle used in box-bellows and other types. The filling of the reservoir gradually releases the double-pulley string, which lowers airtight framed shades within the box. When the reservoir is full, the shades are closed and fresh air is kept out; the blower continues to run, and the air runs "freely," as it cannot expel the air. When the organ plays, the top of the reservoir lowers slightly, but the pressure stays even. The string opens the shades, enabling the blower to send air into the reservoir once again.

The control of air leaks in the flow of air was a matter of good building skills and materials. However, the development of pneumatics gave builders the opportunity for even more control along the windtrunk, ingeniously using the organ's wind to control itself, in effect. The first significant pneumatic device was the BARKER LEVER, originally designed to reduce key resistance when playing distant pallets or multiple manuals. An engaged key or pedal lever indirectly pulls down a corresponding "pallet valve" to the upper section of a pipeless windchest; this allows air to enter from the lower section. The air continues through a free duct to a secondary bellows (one per key). When filled (expanded downward), the bellows expands downward, pulling down the tracker attached to the actual pipechest pallet; sound is thus produced, according to whichever stops are open. When the the key or pedal lever is released, its pallet valve rises, closing off the upper windchest section from the air supply and raising an exhaust disc valve, allowing air to escape without sounding. This is necessary because the secondary bellows has closed, shutting off the duct's air supply, but not permitting excess air to escape.

Other actions and regulators made use of externally supplied wind within the instrument's internal structure; these offered less dependency on the air's journey through the windtrunk in exchange for greater reliance on technology. Both types of TUBULAR ACTIONS (pressure- and exhaust-pneumatic) had a bellows (secondary motor) inside the pallet box; when full, the pallet was closed; when empty, the pallet was empty. However, the path from manual key to pallet box, involving a primary motor, exhaust pallet or valve, touch box (pressured air supply), lead tubing (individualized windtrunk), and the absence or presence of a vacuum, differed between the two types. The addition of electromagnets to the pneumatic equation replaced the lead tubing, but for the first time allowed the regulation of wind supply to be assisted by forces independent of the instrument itself. Direct electricity (RELAY AND SWITCH SYSTEMS) allowed the control of performance on an "on-off" basis. With the increase in convenience—and freedom to locate the CONSOLE and its pipechests wherever wires could connect them—came the loss of control over action and, with the advent of solid-state electronics, the loss of traditional organ sonorities. It is only with the ORGAN REFORM MOVEMENT and its aftermath that such elements could be reclaimed, even if coexistence with purely twentieth-century technology was inevitable, even helpful.

Finally, the issue of flexible (breathing) versus steady (sustained) wind deserves attention. The performance of older notated music of all kinds had generally been subject to the taste of the times in which the performance was taking place. In addition, instruments and performance styles had changed thoroughly over hundreds of years, even a mere century. Therefore, until the age of sound recording really took off (after World War I, especially after the invention of the LP and recording tape), the re-creation of performance practice and individual styles appropriate to one period, composer, or even piece was dependent at most on a few performance practice treatises, expert or nonexpert verbal descriptions of performances, and the occasionally well-notated manuscript.

Steady wind became an obsession among many organbuilders, composers, and performers in the nineteenth century. Electricity made what had seemed impossible now possible: the ability to attack, hold, and release any note with precise attack, sustain, and conclusion, and the freedom to play as many notes at once without risking the equivalent of a wind surge or drop. But the twentieth century's "reaction" (i.e., anti-Romanticism) included a focus on sound qualities as well as performance practice. Vibrato, ornamentation, instrument construction, tempos, tuning—these are just a few of the issues that have been hotly debated for well over a half-century.

The organ has the additional issue of winding. Whenever an older instrument is restored, shall a repaired or new version of the original system be used, or should the restoration incorporate a different (probably more modern) technology? Should the organ's role at any historical time influence such a decision? Can a compromise be reached that allows changes in a single instrument's winding method to meet the needs of all styles, or is this impractical?

Did Johann Sebastian Bach, who is known to have complained about at least one underwinded instrument, compose with appreciation or in spite of flexible winding? Do all ears prefer a "breathing" approach to playing contrapuntal music? Do elements such as pipe construction and proximity, harmonic and temperament dissonances, and case construction affect the relative stability of tone and pitch? These are important areas of investigation, with any number of answers.

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REIL

Dutch organ-building family of German origin. Founder Johann Reil (b. Munich, 6 Apr 1907; d. 5 May 1960) apprenticed with Moser and Nenninger, Munich (1922–38), then worked in Germany and Switzerland. He erected an organ at Amsterdam's Tuschinski Theater, then decided to remain in the Netherlands. He worked for various builders (1929–34), notably D. A. FLENTROP, then established a organ supply factory in Rotterdam; the firm moved to Heerde in 1937. After rebuilding an organ at Lichtenvoorde, Reformed Church (1936), Reil built his first new instrument for IJmuiden-Oost, Reformed Church (1938), followed by Urk, Kerkje aan de Zee, 1942 (2/15; pneum.; dism. 1981). After World War II, Reil concentrated increasingly on constructing mechanical action organs, including those at Arnemuiden, Reformed Church (1948); Apeldoorn, Barnabaskerk (1953; dism. 2002); and several churches in Drenthe. After Johann Reil's sudden death, his son Albert Reil (1942–2001), who had apprenticed with the pipemaker Busch in Herten, Germany, took over. He built an instrument for Dokkum, Gereformeerde of Oosterkerk (1962). His brother (Jo)Hann Reil joined the business, now Gebroeders Reil, in 1963; Hann had apprenticed as a voicer with KUHN in Switzerland.

While the 1960s was a heady time for the authenticity movement in the Netherlands and elsewhere, the question remained as to why new organs fashioned after historical models never sounded as good as the original instruments of the sixteenth, seventeenth, and eighteenth centuries. The Reils participated in the Schnitger Conference in Groningen (1969), thereupon deciding to build organs carefully based on historical models, in consultation with organist Klaas Bolt (1927–1990). After building instruments for Dieren, Ontmoetingskerk, 1970 (2/10) and Leersum, Hervormdekerk, 1970–73 (1/7), the firm decided to "copy" the 1701 Arp SCHNITGER organ at the Uithuizen, Hervormde kerk (2/24) for Scheveningen, Prinses Julianakerk, 1973 (2/23). Another "copy," based on the 1764 Albert Antoni HINSZ instrument at Tzum, Reformed Church, was installed at Ermelo, Immanuelkerk (1981).

Reil also put its philosophy into general practice, rather than pursuing direct imitation; an early manifestation was the new organ at Hattem, 1976 (2/15; dimensions based on "golden section"). In the 1980s, the firm installed new organs in Austria—Vienna, Augustinian Church, 1985 (2/25; the "Wiener Bach-Orgel," modeled on Silbermann and Trost) and Melk, Benedictine monastery, 1986 (2/14; rest. Reil, 1989; 2/21). New instruments were erected in Stavanger, Norway, Cathedral, 1992 (3/51); Joure, Gereformeerde Kerk De Oerdracht, 1997, 2/25 (repl. 1968 Reil [destr. by fire, 1994]); Kampen, Bovenkerk, 1999 (2/29); and Tokyo, Keisen University, 2002 (2/21).

In recent years, Reil has expanded its historical approach to include nontracker organs, building a new instrument at Heerde, Gereformeerde Kerk, 2001 (2/19), based on a 1920 pneumatic action organ by A. W. J. Standaart (1882–1958), a MAARSCHALKERWEERD student. Reil has restored or reconstructed several instruments, including Siddeburen, Stichting Orgelconcerten (1854 van Oeckelen organ; 1985; 2/20); Godlinze, Reformed Church (1704 Schnitger/1785 Hinsz; 1985; 1/12/pull-down); Rotterdam, Lutherse Andreaskerk (1967 Blank organ; 1988; 2/20); Epe, Cathedral (1809 A. Meere organ; 1994; 2/28); Zutphen, St. Walburgiskerk (1643 Bader/1815 Timpe organ; 1996; 3/38); and Delft, Waalse Kerk (1869 C. G. F. Witte organ; 2000; 2/25). The firm also produces historically based house organs, positives, and "portatives" (really small positives) for the trade.

Gebroeders Reil has been involved with a highly controversial restoration involving the Schnitger organ at Groningen, Aa-kerk. Schnitger built an organ for the church (1694–97), but it was destroyed by fire in 1710. The Aa-kerk had no organ until 1815, when a 1702 Schnitger at the city's Academiekerk (Broerekerk) was moved there by J. W. Timpe. An 1858 restoration by van OECKELEN involved considerable rebuilding. In 1977, the organ was dismantled while the church (now owned by the city) was being restored; Reil reinstalled the organ in 1990, submitting a plan for a thorough restoration. The plan tried to answer concerns that the van Oeckelen element (also historically important) would overwhelm the Schnitger original. But the plan was revised after Reil discerned deterioration in the case and windchests, stating that some rebuilding was indicated. The state's Department for the Preservation of Monuments and a municipal committee approved a contract with Reil (1997), but the plan angered purists who believed a more "authentic" restoration was not only possible, but ethically imperative. A furious journalistic and epistolary battle ensued, resolved only when the committee reasserted the validity of the Reil contract (1999). The restoration continues.

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RELAY AND SWITCH SYSTEMS

The application of an electrically based means of turning a toggle switch or similar device on and off. Technically, the term *relay* now applies to solid-state electronic devices, while *mechanical relay* denotes the electro-pneumatic and all-electric engineering that developed in the late nineteenth century. In the latter, when initial contact was made (e.g., by depressing a key or drawing a stop), the engaged circuit would "relay" the resulting charge in the form of an electric signal to a device (at first a magnet, later a solenoid wire), which in turn operated the switch. The solenoid's ability to disperse its signal among more than one switch was its greatest strength; it allowed a relay to act like a unit action to more than one location at once. The relay also protected any system-wide device, such as a transformer, from damage in extreme situations. In the sense that a relay and switch (R & S) is a purely binary device, its invention anticipated the digital era; indeed, the earliest computers relied on it to operate. Only later did solid-state electronics make it possible to include many more options within a smaller space—a development that affected all kinds of devices, including the organ.

The first R & S application was in electro-pneumatic ACTION; depressing a key pushed up a contact plate at its back end. The plate completed a wire circuit that activated an electromagnet at the entrance of the pallet box; the magnet caused a small valve (armature) to rise, beginning a two-motor pneumatic relay that eventually pulled the associated pallet down and allowed air from the WINDCHEST into the TOE hole of the pipe. Initially, electro-pneumatic slider-chests, in which the air supply was controlled by the key action and passed through airtight KEY CHANNELS, were adapted in this manner; later, sliderless VENTIL chests, in which wind was supplied through each stop in stop channels and brought into play by key action, received the electro-pneumatic treatment by Hilborne L. ROOSEVELT and other builders. The E. F. WALCKER cone-chest received this treatment, but this device's influence was mostly limited to Germany.

Robert HOPE-JONES and other builders applied the electromagnetic R & S to stop actions (e.g., SLIDERS) and MECHANICAL AIDS (COUPLERS, combination actions). All-electric actions skipped the two-motor relay by having the electromagnet open the pallet directly; the elimination of pneumatics reduced potential noise and maintenance problems. Electricity itself operated the new WINDING device of the late Victorian period, the blower, as well as such older devices as the TREMULANT and SWELL shades. As electric engineering grew in sophistication, the relay's ability to trigger several switches at once was taken advantage of; this principle was subsequently adapted to the development of solid-state electronics.

However, the widest ranging implication of R & S systems was their role in the development of the UNIT CHEST. Duplexing (the control of a particular pipe rank by more than one manual) and extension (the availability of an individual pipe to more than one stop or rank) were developed to save the expense and extra space required by a full set of pipes. Duplexing and, to a lesser degree, extension were originally mechanical in nature; but electro-pneumatic and electromagnetic (all-electric) systems became the preferred method of engineering the unit chest's components.

The "ultimate" goal—extending the unit chest principle to as many different ranks and pipes as possible (the so-called floating chest)—was realized outside the church (which had no need for it) as the fully electric THEATER ORGAN, which borrowed the spirit of the automatic barrel and band organs, tailored it to providing soundtracks for silent films and popular performance, and put it back in the hands of live players, much as GEORG JOSEPH VOGLER must have hoped would happen with the original ORCHESTRION more than a century earlier.

RICHARD KASSEL

RELIEF PALLETS AND PNEUMATIC BALANCERS

SEE ACTION

RESERVOIR

(Ger. *Magazinbalg*, storage bellows). A bellowslike wind-regulating device that receives air from the initial source, originally a feeder BELLOWS, and stores it before it is expelled into the CONDUCTOR SYSTEM, eventually leading to the WINDCHEST, pallet, and pipes. The reservoir must be large enough to hold enough wind for its instrument, especially when air is being drawn for a large number of pipes simultaneously. While reservoirs are not categorized as REGULATORS, the distinction is somewhat semantic: the reservoir was the first device invented to control the flow of air from the bellows (mid-eighteenth century).

PARALLEL RESERVOIRS consisted of one (single-rise) or two (double-rise) ribbed wooden sections, their folds held together by external struts, resting on an immobile "well." In many cases, the ribs were "inverted," the lower ribs closed inward, the upper ribs closed outward, helping to stabilize exhaust pressure. The ribbed sections expanded with the incoming air; weights on the reservoir's top forced the expulsion of air into the WINDTRUNK (a pulley system was later incorporated). The entire reservoir rested on its WINDING source, a multifold feeder-bellows, operated by mechanical lever; a nonreturn valve in the bellows controlled the airflow. Earlier systems connected two identical multifold wedge bellows, one feeding air into the other. The reservoir concept survived the evolving methods of winding—water pressure, electricity, and rotating-fan motor; by the early twentieth century, a series of fans could feed an organ's reservoirs at specified pressures, the culmination of ARISTIDE CAVAILLÉ-COLL's work with windchests during the mid-nineteenth century.

A second type of reservoir, invented in the nineteenth century, is known variously as a "pneumatic regulator," "schwimmer bellows," or "schwimmer valve." The semantic confusion is unnecessary; most treat the SCHWIMMER as a regulator. However, the schwimmer can function as a true reservoir, unlike the concussion bellows, which only serves as a regulator. Above the schwimmer's frame is a wooden lid, attached to the frame on all sides by airtight rubber cloth. The flexible cloth allows the lid to move freely up and down with changes in the WIND PRESSURE; springs or weights are used to counteract the pressure of wind entering the reservoir. If the schwimmer is serving as a reservoir, an exhaust valve is incorporated; if acting as a regulator, it may be placed on the wall of the relevant windchest or similar component.

In either form, the reservoir has served its dual function of storing and regulating wind whenever solid-state electronics have not been the sole means of producing organ sound, in the preelectronic era as well as the post–World War I emphases on authenticity, restoration, and eclecticism.

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RESONATOR

The upper portion or body of a reed pipe, usually made of metal (occasionally wood). The narrow bottom (BOOT) of the resonator rests on top of the block that houses the SHALLOT/tongue/wedge assembly, which produces the initial sound when given wind. The shape and length of the resonator largely determines its timbre; the pitch of a reed pipe depends on the speed of the vibrating tongue in the lower portion of the pipe, rather than the length of the resonator, as in a flue pipe. (The term *resonator* is sometimes applied to flue pipes, although timbral considerations rather than pitch are the primary function of a flue pipe's upper portion.) Reed resonator lengths vary widely, affecting the harmonic (overtone) content (and therefore the timbre) of a pipe.

Achieving optimal reed sound has many contributing factors. The longer the tongue, the shorter the resonator; but when the natural frequency of the air column is greater than for the tongue, the harmonic tone is richer in partials. Brightness of tone can also be affected by the degree of openness in the shallot and the material for it. The thickness of the tongue, scale of resonator, and the angle of tapering in a conical resonator in relation to its length are other factors.

Metal resonators are usually circular in horizontal cross section. There are three principal resonator shapes. The first is conical (flaring or bell-like), usually open, generally close to or equal to their sounding-pitch length (when compared with flue pipes). Resembling the design of brass instruments, conical stops include the BOMBARDE, FAGOTTO, OBOE, SCHALMEI, TRUMPET, FRENCH HORN, and TROMBONE. The second type is cylindrical, either open or partially stopped; the length of such resonators needs to match the pipe's stated register (much like flue pipes). (OVERBLOWING double-length pipes with a small, strategically placed hole produces HARMONIC STOPS.) Cylindrical pipes, which recall the woodwind family, include the CLARINET, some KRUMMHORNS, RANKET(T), SORDUN, DULZIAN, some VOX HUMANAS, Zink, and George Bernard Shaw's beloved Corno di Bassetto (BASSETT HORN). the third type is inverted (conical), much less frequent, found in Cornet, MUSETTE, and other Vox Humana stops. Other pipes come in all types, notably the REGAL family, whose resonators are often half-length. Finally, there are the pipes that combine elements of two or more shapes, such as the BÄRPFEIFE, ENGLISH HORN, KINURA, and other Dulzians and Regals.

So-called full-length reed resonators have a good balance of their fundamental and corresponding overtones. "Fractional-length" resonators are shorter than the equivalent open flue pipe, specifically one-quarter, one-half, or three-quarters of its sounding length; these pipes are designed to emphasize specific overtones at the expense of their fundamental. Fractional-length resonators are found on cylindrical reeds (Clarinets, Krummhorns, Vox Humanas) and bass registers of many conical reeds in cases of limited space. STOPPED PIPES make this latter application possible, but careful VOICING is compulsory to make the rank's timbre consistent throughout. A third group of resonators is longer than the sounding length, resembling harmonic stops. As with their flue counterparts, the harmonic reeds emphasize the fundamental. Weaker upper-registral ranks may be reinforced by use of harmonic Trumpets, CLAIRONS, TUBAS, and other harmonic reeds.

See also **Half-Length Stops; Lingual**

RICHARD KASSEL

RESTORATION

In the general museum field, restoration is now universally defined as an attempt to put an object back as close to original condition as possible. In instances where an object cannot be successfully restored because of excessive damage, tampering, or unidentifiable missing parts, it is usually simply stabilized and preserved in its incomplete state as a study object, and often is not exhibited. These approaches work best with inert objects that need only to be touched or seen—paintings, sculpture, furniture, and so on. With any sort of "working" objects—machines, appliances, clocks—the problem is more complex. Should the object be restored only cosmetically, or should it be restored to working order? Experts do not always agree on this issue, and the policies of museums and collectors tend to vary here.

Musical instruments must be classed as "working" objects, but with a subtle difference. Most other mechanical objects have a strictly utilitarian purpose, despite often attractive visual features; a splendidly ornamented clock, for example, only tells time, and does so in a consistent and predictable manner. Musical instruments, on the other hand, are artistic objects as well as performance media, the necessary vehicle for the realization and interpretation of written music. They are meant to be heard as well as seen; to be heard, they must (with the exception of automata, self-playing instruments) be played.

This places musical instruments in a unique category with regard to restoration. Many conservators would prefer to restore the visual components of a handsomely painted virginal or a lute with an intricately carved rose and pegbox and to place it in a glass case. To a musician, musicologist, or student, however, such instruments are valid performance media, as well as a link with the musical past. A fully restored and playable antique instrument thus has value to listener and researcher alike in addition to its historical and visual worth. To the musician, therefore, the desirable object of restoration is to make the instrument playable again.

A question that must be addressed is to what state (or stage) a historical instrument should be restored. Necks and fingerboards of seventeenth-century violins may have been altered in the eighteenth century; five-string guitars converted into six-string guitars; natural brass instruments fitted with keys or newer crooks. The larger the instrument, the more numerous and problematic the possible alterations. The compass of early harpsichords was frequently extended downward in the Baroque period (*ravalement*), often by a notable maker; some harpsichords were even converted to fortepianos. In the process a certain amount of original material was discarded. Organs present an even more complex problem, in that it is not uncommon to find historic instruments of significant musical merit that retain cases, pipework, and even mechanisms from earlier periods. Not long ago, it was considered correct to attempt to return reconstructed instruments to their earliest state, even though it meant discarding much worthy later material and having to resort to considerable guesswork to reconstruct missing parts. Perhaps not surprisingly, such reconstructions were often unsuccessful from both the musical and historical standpoint. More recently the trend has been to restore the instruments to their last most complete and coherent form, especially if they received that form at the hands of an artistic maker.

If an instrument is incomplete, or seriously altered or damaged, it may well be that neither restoration nor reconstruction is a possibility. In the past, many restorers relied on educated guesswork to reconstruct such instruments. Not infrequently their guesswork was wide of the mark and the reconstructed instruments were musically misleading. Sometimes, too, valuable evidence was inadvertently destroyed that might have been useful to future researchers. Many now feel that it may be more useful to leave an unrestorable instrument in the state in which it was received and, rather than try to reconstruct it, to instead encourage researchers to use it as a model for a studied and playable replica.

If an instrument is essentially complete, regardless of how poor its state of repair, then restoration to playing condition is usually feasible. It must, however, be entrusted only to experienced and reliable restorers, and considerable research should precede the actual work. It may be that a badly damaged part—rotted, cracked, or eaten by woodworm—must be replaced. But it must first be carefully studied and documented, then carefully replicated. The material must be matched as closely as possible, whether it be the glue and varnish of a violin body, the wood of a clavichord soundboard, or the metal of a trumpet bell, fortepiano string, or organ pipe. Unless it is a badly deteriorated material, such as moth-eaten felt, or the bellows leather in an organ (which cannot be removed in a nondestructive manner), the replaced part should not be discarded, but rather carefully preserved.

In historical restoration, modern materials should be eschewed as far as is feasible. A possible exception to this is the use of injectable epoxy resins in order to preserve and make useable parts damaged by woodworm or dry rot that might otherwise have to be replaced. Similarly, common sense recommends the use of such modernities as wood preservatives, mothproofed felt, acrylic metal lacquer, and other treatments that can contribute to the longevity of the instrument.

A good restorer must not only be a fine craftsperson, skilled in the actual making of instruments and the use of hand tools, but ought also to be well-versed in the musical background of the instrument. In the past, essential knowledge of such matters as pitch and (with regard to keyed instruments) temperament was often overlooked. Thus, it was not uncommon to find an otherwise well-restored instrument made to play in modern pitch and equal temperament, seriously flawing in its ability to set forth the music of its era properly. The ability to put matters of pitch, temperament, and even performance practice into historical perspective is just as important to the final outcome as is knowledge of the shape, thickness, and material of period oboe reeds, flute keypads, or harpsichord plectra. Each requires a certain amount of study, both of similar instruments and of writings concerning them.

The nature of the instrument is a determinant in the restoration process. Brass instruments, woodwinds, percussions, plucked or bowed stringed instruments, and wind or string keyboard instruments all have their unique problems, and must be restored by specialists. Most instruments that are restored are the property of museums, collectors, or educational institutions. These can usually be restored very authentically, for when they are played, it is usually by specialists in early music who know how to handle them and to cope with the variations between antique and modern instruments.

The notable exception to the above is organs—especially large organs. These were originally built for churches, and most of them still stand in the churches for which they were built, and indeed are still in regular use for services, teaching, and practice. Not infrequently, certain modifications must be countenanced in these instruments that would be frowned upon in a museum environment. Human-powered blowing mechanisms have been superseded by electric fan blowers, although the original mechanism can be preserved where it has survived; awkward or short-compass pedalboards are sometimes replaced by more modern ones, although again the old is often preserved. Tuning is a particular problem, since tuning to modern pitch is often necessitated by use with modern instruments. While the use of tuning collars to flatten the pitch of organs tuned sharp is frowned upon in some quarters, it may be said to be preferable to either adding metal to the pipe tops or moving and cutting them, which would destroy both scaling and any evidence of nonequal temperament. The collars are removable, and when in use can serve to protect the pipes from overly zealous cone tuning. Modifications to church organs, while sometimes necessary, should however be kept to the absolute minimum, and always limited to areas where there is no danger of compromising the authentic sound, playing action, and wind characteristics.

Once restored, the preservation and maintenance of instruments should be an ongoing concern. The environment should be climate-controlled whenever feasible, and every effort should be made to protect the instruments from excessive dust, dirt, sunlight, and pollution. Small instruments can be kept in closed cases when not in use, but larger instruments often cannot. These larger instruments should, however, be protected to the best of the owner's ability. In the case of large organs, regular maintenance by competent personnel is necessary, and building problems that could prove detrimental (leaking roofs, broken windows, flaking stone or plaster, vermin) should be attended to speedily. Conscientious preservation is, indeed, just as important as good restoration, for without it even the best-restored instruments will be prone to costly deterioration.

BARBARA OWEN

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RESULTANT/ACOUSTIC BASS/ GRAVISSIMA

A stop based on the acoustic effect defined as the generation of differential or resultant tones. When two tones are sounded together, they produce two additional tones whose frequencies are either the sum or difference of the two original tones. This phenomenon can create tones at pitches for which there may be no pipes present in the organ. "Difference tones" are created at all frequencies, but are particularly effective at lower pitches. In the organ, two ranks which sound an octave and a twelfth (a fifth apart) above the desired pitch are usually employed to generate the resultant; if, for example, one sounds a 16' tone (64Hz) and a 10-2/3' tone (96Hz) together, the resultant frequencies will be a 32' tone (96 – 64 = 32Hz) and a 6-2/5' tone (64 + 96 = 160Hz). Of these two pitches, the former (lower) would be considerably stronger.

The Resultant (Acoustic Bass) 32' stop consists most often of a combination of pipes generating the resultant (16' and 10-2/3' being the second and third partials of the 32' overtone series) to provide the notes of the lowest fifth or octave of the stop and true 32' pitch pipes for the remainder. There are cases where the fourth below (21-1/3' and 16', third and fourth partials in the 64' series) is used instead to produce the 32' stop. The Gravissima 64' stop uses the same principle to produce tones in the 64' octave by employing the second and third partials (32' and 21-1/3').

See also **Quint; Stop**

EDWARD L. STAUFF

REUTER

American organ-building firm. Founded by Adolph C. Reuter (1880–1971), Earl G. Schwarz, and R. A. Rueger, the company was incorporated in March 1917 as the Reuter-Schwarz Organ Company in Trenton, Illinois, and built its first organ for Mattoon, Illinois, Trinity Episcopal Church (1917; 2/8). After receiving an order for the Masonic Temple in Lawrence, Kansas, the company moved to that city in 1919.

After Schwarz left the firm, the renamed Reuter Organ Company's prosperity in the 1920s carried it through the Great Depression; but, like similar factories, it was forced to close for war production (1942–45). After organ building resumed, personnel and philosophy would change: Reuter and his nephew Albert G. Sabol, who had been in charge of engineering and design since the beginning, both retired in 1961. Franklin Mitchell, who joined the firm in 1951, became influential in tonal direction; the use of reeds and mixtures was increased, scales were reduced for principals and reeds but enlarged for strings, wind pressures were decreased, and divisions were exposed. More independent stops were employed, and unit organs constituted a smaller percentage of sales. Albert G. Sabol, Jr., gained majority control of the company in 1964 and became its president. From 1968 to 1972, mechanical action organs were provided by an association with HAMMER Orgelbau of Hannover. Mitchell, who had remained as tonal director, purchased the firm in September jointly with Albert Neutel, a native of the Netherlands who had established a Canadian organ firm in 1960.

By the time of its seventy-fifth anniversary in March 1992, Reuter had built 2,157 new organs. Its instruments predominantly had electro-pneumatic action, although a few installations of the 1970s and beyond made use of mechanical or electric slider action. Until the post–World War II years, Reuter organs were tonally conservative, voiced on moderate wind pressure, and usually installed in chambers (although many of the earlier instruments had specially designed cases or facades), following the general trends of American organ building of the time. An "American classic" design was favored in the 1980s and 1990s.

Reuter's more recent large installations include the University of Kansas, Lawrence (1969; 3/71), Colorado Springs, First United Methodist Church (1986; 4/82), and Glen Falls, New York, First Presbyterian Church (1991; 4/128).

ARTHUR LAWRENCE

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REVERSIBLES

SEE MECHANICAL AIDS

RICHARDS, EMERSON (1884–1963)

Politician, organ designer, and arts patron. Born in Atlantic City, New Jersey, on 9 September 1884, Richards was a lawyer who served as a Republican member of the New Jersey State Assembly (1912–14) and state senate (1917–18, 1923–34) from Atlantic County. He also served as a delegate to Republican National Convention in 1936.

An active participant in the American organ maelstrom of the 1930s and '40s, Richards is remembered primarily for having designed the "world's largest organ in the world's largest auditorium," the MIDMER-LOSH instrument in the main auditorium at Atlantic City Convention Hall (1929–32; now Boardwalk Hall). Its dual consoles (seven and five manuals, respectively) controlled 1,439 stops (455 ranks), keyboards of unusual compass (84 and 72 notes), 22 divisions, and between 32,000 and 33,000 pipes. Its completion followed by a year the inauguration of a W. W. KIMBALL organ in the convention hall's ballroom, also designed by Richards. This theatrical instrument, with its twenty-two unit voices, was unusual in employing an ensemble of chorus diapasons and reeds, including mixtures. The ballroom theater organ had the largest number of pipes and stop controls and was the loudest of its type. Richards had "prepared" for these undertakings by designing the largest high school organ built during the interwar period, at Atlantic City High School (1922–25; 5/165; dism.); he followed this with a small instrument for the western end of Philadelphia, St. Mark's, its pipes designed along Schulze lines, a experimental and bright choice for a small intimate church; both were built by Midmer-Losh.

The convention hall main auditorium instrument, although apparently built for serious music, was mostly used for popular music and accompanimental functions. Only when the U. S. Army Air Force occupied the hall during wartime were regular short recitals given (1943–44); these were ended by damage caused by a September 1944 hurricane. Repaired after the war, the organ served to accompany ice skating and ball games; it was partly functional till at least 1998, but both it and the ballroom organs have been dismantled. Fundraising efforts are underway in the hopes of repairing them.

As a designer, Richards was fairly traditional; he clearly liked his dynamics loud and his dispositions Romantic, and rejected Walter HOLTKAMP's call for a return to slider-chests (1939); he became a lively participant in the struggle between the "traditionalist" electro-pneumatic builders and the neobaroque movement, a battle that led to the compromise known as "American classic" ("a blending of modern organ practice with classic design," a term he may have coined). Independently wealthy, he traveled to Europe with G. Donald HARRISON to examine instruments, and published important articles on SILBERMANN organs in the 1930s. Richards complained about CHOIR divisions in American organs, calling them "depositor[ies] for fancy stops and organist's pets that couldn't be distributed elsewhere." He challenged the notion that the Choir was strictly accompanimental; indeed, he believed that Johann Sebastian Bach wrote for a "brilliant and colorful Choir," not the "stodgy" incarnations of the German-American ORGAN REFORM MOVEMENT. This was apparent in his Atlantic City designs, with their unenclosed Choirs on what was for its time low wind pressure (3.5"). He mixed the weightier, higher-pressure Robert HOPE-JONES–style diapasons with the silvery tones of SCHULZE diapasons, although he preferred the stronger fundamental grounding of the former.

Although not a radical in musical taste or approach to organ disposition, Richards instinctively challenged the so-called English-Anglican "tonal approach," octave-based registrations that in excess became thick and uninteresting, and moved gradually toward the not yet self-evident idea of the relationship of style to organ music—in this case, matching the contrapuntal nature of the music (especially the Baroque, in particular Bach) with a brighter organ design, an omen of the postwar authenticity movement. For all his grand designs and relative conservatism, Richards's striving toward the American classic style demonstrates his participation in the spirit of the organ reform movement, if not the letter.

RICHARD KASSEL

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RICHARDS, FOWKES

American organ-building firm. Ralph Richards (b. Sparta, WI, 1955) studied piano, organ, and harpsichord in school and at Oberlin (Ohio) College. While at Oberlin he visited the workshop of John BROMBAUGH and became interested in organ building. He moved to Eugene, Oregon, in 1976 to work with Brombaugh. From 1980 through 1986 Richards was in partnership with Paul FRITTS under the name Fritts-Richards Organ Builders; the firm built exclusively mechanical action organs (eight instruments) for the northwest United States (Seattle, St. Alphonsus, after H. Niehoff).

Bruce Fowkes (b. Salt Lake City, 1958) became interested in the organ after hearing the Mormon Tabernacle instrument in his native city. He studied organ at Brigham Young University (BYU) and Utah State University. While studying at BYU he apprenticed with Michael L. BIGELOW; after graduation he studied voicing with Mathew Copley in London and used the opportunity to study historic English organs. Returning to the United States in 1983, he worked at John Brombaugh and Associates, where he met Ralph Richards. In 1988 Richards and Fowkes formed their own company in Ooltewah, Tennessee.

The company's first organ was built for Greenwich, Connecticut, St. Barnabas Episcopal (1991; 2/35); sixteenth-century north German organs exerted a primary influence on the organ's specification, with pipe scalings and pipe metal alloys derived from the work of Arp SCHNITGER and string voices and mounted cornet patterned after central German models. Most of the firm's subsequent organs have been built using traditional techniques associated with north German organs built between the fifteenth and eighteenth centuries. The firm's objective has been to produce the finest mechanical action organs from the best materials available. The detailed study of acknowledged masterpieces among historic organs has provided both inspiration and insight regarding case designs and tonal concepts. This effort has not been for the purpose of creating copies, but to rediscover the building practices and techniques that produced the original instruments with their characteristic beauty and grace. Some modern applications have been necessary to ensure reliability in churches using modern heating systems.

Other Richards, Fowkes organs include: Stamford, Connecticut, St. John's Lutheran (1995; 3/33); Rocky Mount, North Carolina, First Presbyterian (1998; 2/25); Knoxville, Tennessee, Westminster Presbyterian Church (1999; 2/25); Atlanta, Georgia, St. Bede's Episcopal (1998; 2/17); Boston, First Lutheran (1999; 2/24); Scottsdale, Arizona, Pinnacle Presbyterian (2004; 3/50); and Knoxville, University of Tennessee (2005; 3/41).

DOUGLAS E. BUSH

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RICHARDSON, CHARLES (1847–1926)

Australian organbuilder. Born in London, the son of English organbuilder W. E. Richardson, Charles Richardson trained with his father and later worked for the London firms of HILL AND SON and Henry WILLIS, as well as with Charles S. BARKER in Paris. Emigrating to Australia in 1882, Richardson established an organ manufactory in Sydney and produced some forty new organs for churches in New South Wales and Queensland in the period to 1922, his greatest productivity occurring in the 1900–14 period. He died in Sydney.

Charles Richardson's instruments were generally small and ranged in size from four to seventeen ranks. All were conceived in a conservative Romantic tonal design, constructed with robust mechanical or tubular-pneumatic action and housed in attractive casework. His firm also rebuilt and enlarged numerous other instruments, in addition to installing organs imported from England. Between 1890 and 1926 Richardson maintained the five-manual Hill and Son organ in Sydney Town Hall, carrying out a major overhaul of the instrument in 1904. Four of his employees (T. C. Edwards, G. C. Griffin, C. W. Leggo, and Sydney T. NOAD) branched out to establish their own businesses in Sydney between 1911 and 1926.

KELVIN HASTIE

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RIDGES, JOSEPH H(ARRIS) (B. 1827)

English-born organbuilder. Ridges was born in Southampton on 27 April 1827; his family moved to London when Joseph was a child. He seems to have frequented organ workshops in his neighborhood. He married Adelaide Whitely in 1850; two years later, the couple sailed to Australia. They moved to Sydney and bought a house, and it was there that he built his first organ. This organ was shipped to San Pedro, California, in 1856 and then on to Salt Lake City in 1857. It was installed in the old Mormon Tabernacle and was heard for the first time on 11 October 1857.

Construction had started on a new tabernacle in 1863; Ridges, a Mormon convert, was selected by Brigham Young to plan and supervise a large organ for it. Ridges went to Boston in spring 1863 and contacted William B. D. SIMMONS, one of Boston's leading organbuilders. He also visited the Boston Music Hall, where a new organ was being installed by the German firm of E. F. WALCKER; the casework Ridges designed for the Mormon Tabernacle organ closely resembles that of the Walcker organ. Parts from the Simmons Organ Company in Boston arrived back in Salt Lake City in the autumn of 1863. Ridges needed clear vertical-grain pine for the largest pipes. This choice material was found in Pine Valley, about 325 miles south of Salt Lake City.

Construction of the organ began in January 1866; it was apparently completed or near completion by summer 1869, and had the following specification: Great: Bourdon 16', Open Diaspason 8', Stopped Diapason 8', Hohl Flute 8', Chimney Flute 8', Dulciana 8', Principal 4', Flute Harmonic 4', Twelfth 2-2/3', Fifteenth 2', Grave Mixture III; Swell: Bourdon 16', Open Diapason 8', Stopped Diapason 8', Claribella 8', Principal 4', Stopped Flute 4', Piccolo 2', Mixture II, Hautboy 8', Bassoon 8', Cromorne 8'; Pedal: Open Bass 16', Dulciana Bass 16', Principal Bass 16', Stopped Bass 8', Great Open Bass 32'. Ridges, Niels Johnson, and Shure Olsen were still working on the organ at the end of 1874; Johnson enlarged the organ in 1885 (3/46; added Choir, Echo divisions). This instrument was the basis of subsequent revisions by W. W. KIMBALL, AUSTIN, and the ÆOLIAN-SKINNER ORGAN COMPANY (G. D. Harrison, 1948).

Although Joseph Ridges was not an organbuilder by profession, his instruments for the Tabernacle were remarkable accomplishments, and among the first significant instruments in the western United States.

PARLEY L. BELNAP

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RIEGER

Austrian organ-building firm. Franz Rieger (1812–1885) learned organ-making in Vienna and established a workshop in Jägerndorf (now Krnov, Czech Republic) that soon became known for high-quality instruments. In 1873 he transfered the firm to his sons Otto Rieger I (1847–1903) and Gustav Rieger (1848–1905). Because of their succes,s they moved the firm to larger quarters in 1879. After Otto I's death, his son Otto Rieger II (1880–1920) took over the company, Gustav having retired. The firm utilized cone-chest systems with different actions, and built larger instruments including concert hall organs; but Otto II became an early advocate of the ORGAN REFORM MOVEMENT, with an active program of smaller organs.

After Otto II's death his widow entrusted a school friend and employee of her husband, Josef von Glatter-Götz I (1880–1948), with the leadership of the firm; in 1924 he bought it. In this stylistically complicated era, flexibility was a key to success, so the firm continued to build in a Romantic mode as well as reviving the tracker organ. These organs were exported to many countries. In the 1930s, Josef's sons Egon von

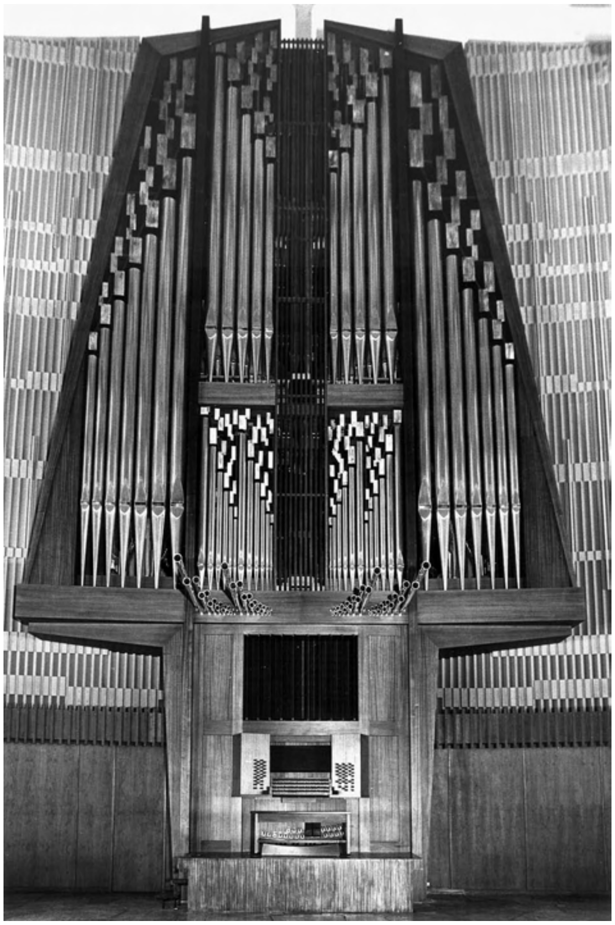

Fig. 66. Rieger organ, 1980 (4/58), Pacific Union College, Anguin, California.

Glatter-Götz (1911–1940) and Josef (II) (Karl Maria) von Glatter-Götz (1914–1989) began working in the company; both had studied at a technological college. Egon was killed in World War II. After the war Rieger was nationalized under the name Rieger-Kloss; it remained a state-owned enterprise until the collapse of the Communist regime.

In 1946, the Glatter-Götz family re-established Rieger Orgelbau in Schwarzach, Austria. After Josef I's death, Josef II took over the firm. He adhered to the mechanical slider-chest and made a six-stop-positive that was used by Paul Hindemith and Herbert von Karajan in orchestra concerts and exhibited and sold at the World Exhibition in Chicago (1950). Innovative instruments made the Rieger name well-known in Europe and North America. In the following years, Josef II's sons entered the firm, newly enlarged in 1972: Raimund von Glatter-Götz (b. 1948), who still works as its organ designer; Christoph von Glatter-Götz (b. 1951), who learned with MARCUSSEN AND SON and became Rieger's manager and owner in 1977; and Caspar von Glatter-Götz (b. 1945), who established GLATTER-GÖTZ Orgelbau in 1993.

In 2003 Christoph had to retire for reasons of health. To maintain continuity, Wendelin Eberle (b. 1963) took over the company as owner and manager. He had started at Rieger in 1978; since 1993, he had been company manager. Rieger continues to design and build organs that display far-reaching vision in innovative case design and tonal concept; their organs are well-crafted and show great stylistic variety.

Rieger instruments include: Bamberg, Cathedral, 1976 (4/78); Angwin, California, Pacific Union College Church, 1980 (4/58); Jerusalem, Church of the Holy Sepulcher, 1982 (2/39); Tokyo, Suntory Hall, 1986 (4/75); New York, Holy Trinity, 1987 (3/32); Hong Kong, Cultural Center, 1989 (4/93); Vienna, Cathedral, 1991 (4/54); Edinburgh, Cathedral, 1992 (3/56); Pretoria, South Africa, Pretoria University, 1994 (3/56); and Christchurch, New Zealand, Convention Center, 1997 (3/42).

CHRISTOPH KEGGENHOFF

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RIEPP, KARL JOSEPH (1710–1775)

German organbuilder. Born in Swabia, Riepp worked with Georg Hofer in Ottobeuren and with Merkel and Johann Andreas SILBERMANN in Strasbourg. He settled in Dijon in 1735; he worked from 1742 with his brother Rupert Riepp (b. 1711; d. between 1747 and 1750), producing organs throughout the Burgundian region; he then returned to Swabia in 1756. He was succeeded by his nephew Joseph Rabiny (1732–1813).

Riepp's instruments were held in high regard by François BÉDOS DE CELLES, François-Henri CLIQUOT, and Silbermann. The instruments built while in Dijon are grounded in the French classical tradition that he took from Silbermann. Most of Riepp's French instruments were destroyed during the Revolution. The early Swabian instruments are French-styled, but tinged with German elements. The pedals tend to be Germanic along with the auxiliary 8' stops. The two instruments at the Benedictine abbey in Ottobeuren (1761–66) were among the best of the day, with exceptional solo reeds and mutations and a fully developed pedal. They were capable of providing all classical French registration combinations, especially on the Récit and Écho, as well as the full plenum with mixtures and solo chorale combinations of the German repertoire. Riepp constructed three organs at the Cistercian abbey in Salem am Bodensee: the Liebfrauen organ (1766–68; moved to Winterthur, Stadtkirche; case incorp. Walcker, 1887–88; rest. Kuhn, 1980–84 to 1888 state), the tabernacle organ (1771–74; moved to Konstanz, St. Stefan; case incorp. G. Maucher, 1817; dism. 1858), and the basilica organ, which remains there and is in use.

Riepp was an early and important builder of so-called compromise instruments, organs that brought together French classical and German Baroque elements. These instruments allowed organists to perform the more diverse repertoire that began to be disseminated throughout Europe. Riepp met the demand for eclectic instruments most artistically in Ottobeuren. While truly grounded in the French classical style, he synthesized elements of French and German styles, creating historically important instruments.

BRIAN DOHERTY

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RIPIENO

(It., "stuffed") An Italian stop dedicated to one rank and timbre, at times virtually synonymous with the Principale (PRINCIPAL), otherwise incorporating it; akin to the French PLEIN JEU. During the fifteenth and sixteenth centuries, Italian organbuilders transformed the medieval BLOCKWERK into multiple-stop instruments, each controlling one rank. Unlike the rest of Europe, one-manual instruments were the Italian norm until the turn of the twentieth century. Stops were indicated by timbre (Principale, Flauto) or lowest pitch in relation to the lowest foundation pitch (Ottava or II, Quintadecima or XV).

Confusion between the ripieno and Principale stems from the sharing of the lowest register (8'; 16' in larger instruments). A ripieno chorus might include the 8' Principale and stops at the octave, fifteenth, nineteenth, and upper octaves and fifths, all the way to the 1/2' four octaves above the fundamental.

The subtle, gently winded ripieno had ceased to be the basis of Italian organ building by the twentieth century, when a more international approach attracted local builders. But it proved attractive to other European builders, who developed a so-called Italian division during the height of the ORGAN REFORM MOVEMENT; it continues to be included in some new instruments, occasionally as a main division.

See also **Stop**

RICHARD KASSEL

ROBJOHN, THOMAS (1809–1874)

English-born American organbuilder. Born in Tavistock, Devon, on 24 September 1809, Robjohn served his apprenticeship under John Gray (later of GRAY AND DAVISON) in London. By 1834, he had emigrated to Troy, New York, where he built pianos and organs. Between 1838 and 1846, he was foreman of the Firth and Hall organ shop in New York City, succeeding Henry CRABB in that post. After working twelve years at other professions, he returned to organ building in 1858 with his brother William Robjohn (b. Tavistock, Devon, 14 Feb 1803, d. New York, 29 Apr 1878) and William Pye, a New York pipemaker. After 1862, Robjohn became an employee of the ODELL firm. He died in New York City on 22 July 1874.

Although Thomas Robjohn built only about fifteen organs, they were mostly large instruments and had unusual features that garnered considerable press coverage. He was reported to have been the first American organbuilder to use pneumatic key action, and he held patents for numerous inventions, including the concave-radiating pedal keyboard (1858), although he did not invent it. William held the patent for one of the first completely adjustable combination actions used in organ building (8 May 1866). Thomas's largest instruments were built for St. John's Chapel (1840), Rutgers St. Presbyterian Church (1845), and South Dutch Reformed Church (1859–1862), all in New York City; Buffalo, New York, Trinity Episcopal (1843); and Holy Cross Episcopal Church (1844) and First Presbyterian Church (1858), both in Troy. In general, Robjohn organs were characterized by splendid, carved casework, mechanical ingenuity, and forward-looking tonal design.

STEPHEN L. PINEL

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ROCOCCO

SEE BAROQUE

RODENSTEEN

Dutch family of organbuilders, also known as Raphaëlis, Rottstein, and Rottenstein-Pock. Israel Rodensteen, the earliest known member of the family, built an organ in Utrecht, St. Pieter (1507–08). (Gabriel) Raphael Rodensteen (d. between 26 October 1552 and 4 September 1554), who may have been the son of Israel Rodensteen, became a citizen of Vollenhove in Overijssel (then under the jurisdiction of the bishop of Utrecht) in 1527 and then moved to Bolsward (Friesland) in 1535; he was still living there in 1552. He likely built the organ at Bolsward, Martinikerk (ca. 1540; part of case extant).

Hermann Raphaëlis (Rodensteen, Rottenstein-Pock; b. Vollenhove, ca. 1515; d. Weimar, 8 July 1583) was the son of Raphael. About 1550 he was summoned to Denmark to build an organ for Roskilde Cathedral (1553–55, some stops extant) and Copenhagen Castle (1556–57). He then settled in Saxony, married the daughter of the organist in Zwickau (1559), and was granted citizenship there (1562).

Raphaëlis was among a number of Dutch organbuilders who worked primarily outside the Netherlands. Given the prominence of his earliest known organ (Roskilde), he must have already had a well-established reputation. He built an organ for Dresden, Schlosskapelle (1563; 1/13); the surviving specification instructions for it are among the most significant of the sixteenth century. His other organs include: Chemnitz, St. Jakobikirche (1559); Zwickau, St. Katharinen (1560–62); Waldenburg

(1562–63); Weiden, St. Michael (1565); Schweinfurt, Stadtkirche (1570); Bayreuth, Stadtkirche (1573); Leipzig, St. Thomas, positive (ca. 1580); and Freiberg, Nikolaikirche, small organ (ca. 1580). He also renovated or enlarged several organs in Leipzig, Nürnberg, and Zwickau. The organ in Queen Dorothea's Chapel in Sønderborg Castle (ca. 1570; reconstr. Kjersgaard, 1996) is attributed to Raphaëlis. It may have had a similar design to the Copenhagen Castle organ, with Great and Positiv divisions. The instrument is the world's only surviving "F-organ," where the note C sounds an F or F♯; in modern terms, this makes it a transposing instrument.

Gabriel Rodensteen (b. Bolsward, Friesland, ca. 1535; d. after 1607), another son of Raphael, worked with Raphaëlis in both Denmark (Roskilde Cathedral, 1553–55) and Saxony. He later became an independent builder in Franconia and Bohemia. He built an organ for Königsberg, Stadtkirche (1582) and another for Hof, St. Michael. Raphael Rodensteen, son of Raphaëlis, was also an organbuilder.

Douglas E. Bush
Ole Oleson

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RODGERS ORGAN COMPANY

See Electronic Organ

ROETHINGER

Alsatian organ-building family. Edmond-Alexandre Roethinger (b. Strasbourg, 12 Apr 1866; d. 20 Feb 1953) was apprenticed to and then worked for Heinrich Koulen, a Swabian organ maker (1881–89). He then spent three years in Munich with Franz Borgias Maerz, for whom he built nineteen instruments, notably an organ for Joseph Rheinberger. He spent his spare time visiting other German and Austrian organ makers.

With his father's help, Roethinger opened Maison Roethinger in Schiltigheim, a suburb of Strasbourg (1893). The instruments he built there were strongly influenced by Koulen, with pneumatic tracker action and pneumatic soundboards. Despite early difficulties caused by unreliable pneumatic soundboards, the workshop had grown to nine employees by 1895. Early commissions were modest, primarily from rural parishes; the first Strasbourg organ was not built until 1902 (St.-Pierre-le-Jeune, 2/24). After 1910, thanks to the support of the canon François-Xavier Mathias, Roethinger was able to install his first three-keyboard organs, at Strasbourg, St.-Pierre-le-Jeune (1910; 3/37) and Ste.-Madeleine (1913; 3/47); and Dannemarie (1913; 3/40). His masterpiece of the period, however, was the organ for Erstein (1914; 3/64), which has been preserved intact and is now classified as a historical monument.

After World War I, the Roethinger firm became the most important organbuilders in Alsace, with Max Roethinger (b. 2 Nov 1897; d. 22 March 1981) taking over his father's role as workshop director. During this period the workshop reconstructed the cathedral organs of Strasbourg (1935; 3/43) and Amiens (1937; 3/58), and delivered new organs to Brussels (Carmes, 1934) and Oslo. Still well-preserved to this day are the organs built for Dornach (1932; 4/59) and Bischheim (1933; 4/49); both display the influences of the Alsatian Organ Reform Movement.

Maison Roethinger trained or employed most of the organmakers who, in the twentieth century, made Alsace famous for its organ building (Alfred Kern, Jean-Georges Koenig, Ernest Muhleisen, and Georges Schwenkedel). After World War II the workshop expanded, becoming one of the most important in all of France, and adopted a neoclassical style, culminating in the instrument at Arras Cathedral (1962; 4/76). From 1960 on they tended more toward a neobaroque manner, under the influence of organist Michel Chapuis and voicer Robert Boisseau, who often worked for them as a subcontractor. With its tracker action and full specification, the organ of the Immaculee-Conception in Schiltigheim (1960; 3/24), voiced by Max's son Andre Roethinger (b. 9 Feb 1928), embodies this evolution. The organ of Schiltigheim, Ste.-Famille (1968;

3/36) was the swan song of the workshop, which had built over 170 instruments in all.

CHRISTIAN LUTZ

ROHRFLÖTE/CHIMNEY FLUTE/FLÛTE À CHEMINÉE

(1) A half-stopped metal or wood Flute of 16', 8', 4', or 2' (occasionally 1' or Quint) register on the manuals, relatively large-scaled and moderately soft. In wood pipes and some metal pipes, the opening is a small hole bored into the wood cap. But in most metal examples, the distinctive element is the "chimney," an open thin tube soldered in the otherwise stopped resonator. The chimney may be external (visible) or internal (directed downward from the cap); its effect is of a liquid stopped Flute with additional (even-numbered) partials reinforced; only the third partial (twelfth) is dampened. Because of the unusual relationship between the body and the chimney openings, inharmonic partials result. Nonetheless, the stop is effective in mutation and other blends.

(2) A class of pipes with the distinctive chimney design dating back to at least the end of the fifteenth century in Germany, but subsequently popular with Dutch, French, Spanish, English, and American builders as well; also called Rohr or Chimney. The design is applied to other Flutes and classes (Bombardon, Bourdon, Gedeckt, Gemsflöte, Quintadena, Shawm) and fractional stops (Quint, Nasat, Twelfth).

See also **Stop**

ROLLER-BEARD

SEE BEARD

ROLLERBOARD

In a tracker ACTION (Renaissance and thereafter), an internal vertical board, parallel to the KEYBOARD, to which are attached cylinders, or rollers (originally wood, now metal), one per key. The rollers revolve around their central axis and have short rigid arms on either side. A TRACKER or similar connection from the KEY is attached to one roller arm; when the key is played, the tracker pulls the arm "down," moving the roller a short distance toward the front. At the other end of the roller, the attached arm pulls down another tracker, this one attached directly or indirectly to the windchest pallet (or valve); when activated, the pallet is pulled down and the associated pipe or pipes sound.

With its action transferred (transmitted) sideways, a manual of normal size can control a much wider sequence of pallet chests, making a larger instrument possible. One of the more ingenious inventions of the period and applicable to instruments with balanced or suspended key action, the rollerboard system was crucial in making mechanical, Hauptwerk-based, cathedral-sized instruments possible. Some suspended action instruments later used splayed trackers or backfalls to accomplish transmission, but this was more practical for smaller instruments.

RICHARD KASSEL

ROLLSCHWELLER

Crescendo pedallike device developed by German organbuilders in the latter nineteenth century. It allows an organist to put on preset registers or stops gradually by manipulating a rotating drum at foot-pedal level. Generally, three complete rotations would complete the gradual full crescendo or decrescendo. The rollschweller could also serve as its own on-switch device when brought to a certain position; a separate piston turned the device off, to be followed by reengagement of the rollschweller. This and similar devices were criticized for sonic inefficiencies caused by differences between original pipe voicings and the changing wind pressures. The rotating drum mechanism was superseded by the balanced hinge (pivoted) pedal. The rollschweller family never achieved the popularity of the SWELL pedal with builders or composers.

See also **Mechanical Aids**

RICHARD KASSEL

ROMANTIC ORGAN

The market for organs declined considerably during the post-Enlightenment era of governmental control over churches (as spearheaded by Emperor Joseph II of Austria) and the "secularization" of churches by French revolutionaries and Napoleonic conquerors. But the Congress of Vienna (1815) signaled a return of organized religion's vitality in Europe, albeit with less influence than in the past. The return of churches to their intended function meant the usual modernization or replacement of instruments; in addition, however, the population growth throughout Europe and North America resulted in new churches being erected in urban and rural settings; new organs had to be built for them. Civic pride dictated the building of impressive municipal concert halls (London's Royal Albert Hall is an example); this impulse necessitated the creation of organs, impressive and sophisticated, to be worthy of the city they symbolized.

The qualities that distinguish the nineteenth-century organ from its predecessors involve both evolution and retreat. After an initial period of consolidation, technological change came at an unprecedented rate in ACTIONS, WINDING, and BELLOWS. The instrument grew steadily larger. DIVISIONS such as the SWELL (an updated RÉCIT) and SOLO (a group of nonblending stops) gained new prominence at the expense of the CHOIR or POSITIV (sometimes integrated into the GREAT). There was considerable experimentation in the creation of new stops, and orchestral sounds hinted at in the previous century became standard. On the other hand, there was a tendency to standardize stops, most notably an emphasis on 8' and other FOUNDATION STOPS. The overall stylistic shift from contrapuntal to homophonic music was duly reflected, with emphasis on the needs of congregational singing. Georg Joseph VOGLER's disdain of MIXTURES and MUTATIONS was reflected, consciously or not, in the dispositions in most countries. Organ CASE design retreated from Baroque and Rococo glories into a classical or Biedermeier phase; some cases reflected the neogothic revival present in Victorian and other late nineteenth-century aesthetic movements.

While there continued to be national styles of organ building, a more international approach developed with the easier flow of information between countries. British builders shared new technologies with the French (e.g., John ABBEY and Aristide CAVAILLÉ-COLL). German builders had a renewed influence on the British (e.g., SCHULZE's organ at the 1851 Crystal Palace Exposition). British, French, and Netherlandish builders gave the PEDAL division equal weight to the others, much as German builders had since the Baroque. Spain and Portugal had begun to lose their organ-building luster during the previous century, and a combination of colonial priorities and financial limitations prevented Iberian builders from participating in developments elsewhere. Italy continued on its independent path, expanding from its one-manual norm mostly to include Solo divisions. North American builders interacted with their European brethren; occasionally hoopla continued to surround a newly imported instrument (Boston, Music Hall, E. F. WALCKER, 1863). Immigrants established successful firms in New York, while the homegrown New England school culminated in the works of HOOK AND HOOK, George S. HUTCHINGS, and others. The East Coast continued to receive builders from Germany and England, while other immigrants went to the Midwest. Local builders began to pop up as far west as California. In Montreal, the CASAVANT FRÈRES firm began its long domination of the Canadian market. By the end of the century, Hilborne L. ROOSEVELT and other North American builders were the equals of European firms in grandiosity, technological savvy, and tonal imagination.

Standardization was an important theme of many developments. Pipe scaling had been the subject of writings by François BÉDOS DE CELLES, Marin Mersenne, and GEORG ANDREAS SORGE, but Johann Gottlob TÖPFER (ca. 1845) presented a logarithmic/rational formula (using a factor of 1 to the square root of 8 for each successive pipe) that provided organ-building factories as well as inexperienced builders with a system for pipe SCALING. Specialization and power-driven tools (first steam and later, electricity) allowed builders to create "industrial age" instruments on the nineteenth-century equivalent of the assembly line. Wholesale manufacture of individual parts (in addition to pipes) became an important adjunct to the trade. Catalog sales of ready-made instruments made it even more difficult for smaller workshops to compete. Manuals ranged from fifty-six to sixty-one keys; pedals were more irregular in width, although Britain's Royal College of Organists set a thirty-note standard for a radiating-concave pedalboard late in the century. (The AMERICAN GUILD OF ORGANISTS [AGO] followed suit in the 1930s, with the manuals set at sixty-one keys, pedals at thirty-two.) The radiating-concave PEDALBOARD was officially adopted by the AGO and highly popular in England, but did not take hold in continental Europe; those builders continued to use the flat or concave pedalboard (but not radiating).

A preference for foundation stops came to dominate English, Low Country, and North American organ building almost entirely; German builders retained some of their beloved mixtures, while Cavaillé-Coll and his contemporaries kept their TIERCE (and newly created) Septième (TWENTY-FIRST) mutations. The most significant change in overall tonal design was the integration of the English Swell division into other national styles, such as the French *orgue expressif* and the German *Schwellwerk*, at the expense of the Choir or Positiv. The Swell's gradual crescendo and decrescendo, controlled by a pedal or foot lever, induced greater or lesser pressure on reeds. The availability of the Swell influenced the compositions of the French and German organ schools of the era; but when twentieth-century builders began to produce neobaroque instruments, the Swell was destined for exclusion, although it would survive in THEATER ORGANS, electric and ELECTRONIC ORGANS, and neoromantic instruments.

The earlier forms of MECHANICAL AIDS—COUPLER, MACHINE STOP, and *tiratutti*—were supplemented in the Romantic period by the development of combination actions. Operated by hand, foot, or knee, these devices added or subtracted stops more easily and with greater variety than leaping from one manual to another or having assistants manipulate DRAWSTOPS on the fly. Initially these combinations were preset by the builders and operated via a stop-knob or a separate pedal. Later, piston controls were placed on or below the console, allowing a variety of "free combinations" to be set by the performer. The French and English were the first to apply combination actions vigorously; German and American builders had followed their lead by mid-century. By 1900, the inclusion of combination actions had become an end unto itself, an excess shared in other categories of organ building in this era, and part of the late Romantic trend toward gigantism, particularly in Germany and the United States.

The tonal qualities of the nineteenth-century organ had been expanded somewhat by the FREE REEDS, especially in lower registers; but initial interest faded, and its use in pipe organs was localized and negligible by the end of the century. Its simple construction and potential for expressivity led to the harmonium or REED ORGAN, highly popular in nineteenth-century homes; it would also have a place in the next century's theater organ. Far more important were "orchestral stops." As Owen has noted, the orchestra of the late classical and early Romantic eras was increasingly flexible in its possibilities (new instruments, freer use of homophonic and contrapuntal textures); the fortepiano, which struck death blows to the harpsichord and clavichord in the eighteenth century, metamorphosed into the grand piano with its large range and flexibly wide dynamics. The most popular organ repertoire, orchestral transcriptions, represented the sounds of a new, far more secular world, not "old-fashioned" church music. Even when Johann Sebastian Bach's music began to be revived early in the nineteenth century, there was a historicist, almost antiquarian element to that revival, and organbuilders (especially German) expanded their philosophies and instruments to try to incorporate a Bach "sound" rather than meet the master's organ music head-on. Indeed, British performers were especially inclined to believe that Bach had had a Swell division in his instruments.

The builders' response: the imitation of orchestral sonorities (another Vogler cause), already a part of the pipemaker's repertoire, now became an obsession. Every instrument in the orchestra was the subject of attempts at replication; the creation of parallel universes of familiar organ versus orchestral timbres led to problems with tuning and blending. The most significant technical developments were the HARMONIC STOPS, double-length flue stops with a pinhole at or near the middle of the pipe, and stops, reed or flue, blown on higher-than-usual WIND PRESSURES. Voicing, which had previously avoiding nicking wherever possible, now included extensive nicking as a matter of course; the addition of EARS and BEARDS around the pipe mouth and even leathering potential leaks was necessary to blend the sounds. The Solo and its relatives (Récit, BOMBARDE, even the ECHO) became major divisions, rather than havens for a few unique stops; these divisions isolated such distinctive stops from the Chorus and Principal ranks. The Diapason, once the centerpiece of the British organ, disappeared.

At the beginning of the Romantic era, many saw the future of the organ in terms of the blossoming orchestral stops; the organist would be able to imitate the symphony orchestra in all its glory. Pre-Romantic EXTENSION ORGAN concepts such as duplexing (accessing a single rank on two or more keyboards) and borrowing (enlarging the range of a rank by using pipes from others) were adapted to provide greater flexibility as well as the capacity to increase the number of stops derived from a predetermined number of ranks. French and German builders anticipated the symphonic organ in their larger instruments. In the new century, ERNEST M. SKINNER, AUSTIN, and MOLLER were the most active builders of the orchestral organ, George A. AUDSLEY its most persistent spokesman; he designed the Murray M. HARRIS organ for the 1904 Louisiana Purchase Exposition in St. Louis. But the "serious" visions of Skinner and Audsley could not compete with the theater organ; any remaining interest in the orchestral organ was finally killed off by war, economic downturns, and the ORGAN REFORM MOVEMENT and its successors.

Four technological areas saw dramatic change during the Romantic era: winding, bellows, windchest, and key and stop actions. WINDING had always been the responsibility of manual laborers, their number depending on the size of the instrument. These CALCANTS later worked with hand-driven rotary fans, which lessened the burden somewhat; newly designed bellows, reservoirs, and feeders helped by processing wind more efficiently. But by mid-century, urban builders incorporated low-horsepower steam engines (located behind a wall or on a different floor) to produce the air; one complication was the need to "heat up" the engines far in advance. Gas engines were used similarly later in the century; there was no need to "warm up" the motor, but the gas supply was more volatile. The WATER MOTOR (with only passing resemblance to the ancient HYDRAULIS) took advantage of urban water mains (churches were tax-exempt) by using the pressure generated to operate the winding process. Hydraulic engines were also free from lengthy preparation time, but the pressure provided was unpredictable and, in some places, unavailable on Sundays!

No single method was adopted everywhere, and human backups were commonplace. Steam was most popular in Britain, but made some headway in the United States (the 1863 Walcker at the Boston Music Hall). Water motors were commonplace in North American and English cities (Liverpool, St. George's Hall, Willis, 1855). Although widely advertised, gas engines never became as popular (Ulm Cathedral, Walcker, 1856, 1886 renovation). Generally, German and French organs were still hand-blown until late in the century, when builders in all countries began to use electric batteries to operate "forge blowers." Originally hand-cranked, these enclosed centrifugal rotary fans were adapted so as to blow a sufficient, regulated air supply into the RESERVOIR (Boston, Our Lady of Perpetual Help [Mission Church], Hutchings, 1896–97). When alternating current became widely available, most builders adopted the "electric blower" in all but the smallest instruments; a few companies based their business primarily on supplying rotary fans (the Ventus line of LAUKHUFF).

Long before winding became the focus of attention, builders were attempting to make bellows more efficient. The WEDGE BELLOWS of the medieval organ remained available. Two Baroque gravity-assisted pulley systems, the lantern-bellows and the box-bellows, were still explored in the Romantic era. The most significant development occurred during the eighteenth century: the combination known as the reservoir and feeder-bellows. This mechanical system not only supplied air to the CONDUCTOR SYSTEM but regulated the flow of air in and out of the instrument to avoid pitch and pressure problems in the sounding of pipes. Later powered by steam, water, gas, or electricity, the reservoir and feeder-bellows system benefited greatly from the electric blower. Electrification also improved the tiered system of wind pressures, developed by Cavaillé-Coll, HILL, and others, that channeled one airstream through more than one reservoir to ranks of pipes requiring different levels of pressure.

Perhaps the most ingenious development in nineteenth-century organ building was the application of one of the organ's oldest principles—pneumatics—to the action. Builders realized that with all the air being sent into an instrument, some could be diverted to serve other functions. In the 1830s, the earliest such pneumatic, eventually known as the BARKER LEVER, placed a second bellows between an initial pallet-valve chest and a tracker that controlled a pipechest pallet, one per key; this improved the action of the organ, a need that grew as larger instruments were built. This device became a signature element of Cavaillé-Coll's organs (beginning with Paris, St.-Denis, 1837). The tubular-pneumatic actions that developed in the 1840s and '50s in France depended on tubing, two pneumatic "motors," and a pallet windchest to transmit stop and key actions; the "exhaust-pneumatic" system (releasing air to play a note) worked more effectively than the "pressure-pneumatic" system (increasing air pressure to play a note), which was more sluggish. Although prevalent in England (London, St. Paul's, Willis, reb. 1697 Smith organ, 1872) and to some degree in the United States and Germany, tubular-pneumatic action was too slow for many builders. These builders bypassed the tubular-pneumatic phase entirely, going directly from Barker lever–aided tracker action to electro-pneumatic actions, developed in France in the 1860s. In this system, the key action set off the contact plate of an electrified magnet; this affected the closing of an armature valve, initiating the double-motor process. In 1895, Casavant Frères rebuilt an 1852 WARREN instrument with electro-pneumatic action. Electro-pneumatics were also applied to Barker levers, sliders, couplers, and combination actions; they were an essential element of the UNIT CHEST, used in theater organs before World War II. Like the symphonic organ, electro-pneumatics were considered anathematic by organ reformers, although their elimination from the neobaroque organ did not occur until the 1960s.

The slider-chest windchest (invented in the late Middle Ages) remained the norm with most European and North American builders; more complicated systems were vulnerable to changing atmospheric conditions. The Renaissance introduced the spring (KEY CHANNEL) windchest, more difficult to manufacture, easier to maintain; Italian builders continued its use into the nineteenth century. New types of windchests emerged, however, in which the guiding principle was the absence of channels or grooves. In the cone-valve chest (popularized by Walcker in the 1840s), ranks were placed left to right, parallel to the manuals. Each key operated a simple mechanical action that raised a set of small cone-shaped valves to open the ventil (airway) to all ranks; if a rank was put "on," its corresponding note sounded. The membrane-chest (developed by WILLIAM SCHUELKE in the United States) worked on an "exhaust-pressure" system. Air pressure pushed up a set of leather "membranes" to close the airways; the depression of a key released the pressure below the airway, and if the rank was on, that note sounded. The cone-valve chest remained primarily a Germanic phenomenon; in addition to Walcker, Haas, Friedrich LADEGAST, Wilhelm SAUER, STEINMEYER, and Strebel employed the system. RIEGER, Sauer, and Schmeisser as well as Schuelke were in the smaller group that employed the membrane-chest. New chest types emerged at the turn of the next century: John T. AUSTIN's universal air chest, which fed individual pipes from a walk-in chamber below the pipes rather than pallet boxes or ventil channels, and Skinner's PITMAN CHEST, an electro-pneumatic system with a small valve manipulated by pressure changes in both the key and STOP CHANNELS.

While the early-twentieth-century market demanded player organs and pianos, concert, film, and (later) radio audiences were wowed by secular "monster organs," fueled by electricity and featured numerous duplexed and borrowed ranks to produce what Robert

HOPE-JONES called a "unit orchestra" (UNIT ORGAN) from a remarkably small number of ranks. However disparaged Hope-Jones was by his contemporaries and posthumous critics, he passed on his ideas to the WURLITZER Company, which put them into successful and widespread practice. Wurlitzer and its competitors pushed the pipe organ into retreat; it was not until World War II that the theater organ went into oblivion and the pipe organ could make its return, albeit on more modest terms than late-nineteenth-century builders could have envisioned.

The Romantic organ experienced more significant technological evolution in a century than occurred in the previous half-millenium; only the dividing of the BLOCKWERK, development of tracker actions, and the invention of the ROLLERBOARD had as much influence on the instrument's evolution. Yet all the improvements and sea changes (notably, the adaptation of pneumatics to a variety of uses) were not accompanied by a wealth of great music, a pattern begun in the classical era, a time when organs were relatively stable in their technology. The Renaissance and especially the Baroque periods saw a symbiosis between builder and composer/organist that, in the best cases, resulted in masterpieces of musical craft. The early Romantic organ was a holdover from the eighteenth century; other than Felix Mendelssohn's sonatas and preludes and fugues, the repertoire was now in the hands of the *Kleinmeister* who filled the organist's positions at restored and new churches.

In the latter part of the century, more significant composers wrote for their respective national styles of instrument: France and Belgium (César Franck, Félix-Alexandre Guilmant, Charles-Marie Widor, Louis Vierne), Germany (Franz Liszt, Joseph Gabriel Rheinberger, Julius Reubke, Johannes Brahms, Max Reger, Sigfrid Karg-Elert), and the United States, specifically the "second New England school" (George Whitefield Chadwick, Horatio Parker, Amy Marcy Beach, John Knowles Paine, Dudley Buck, Arthur Foote, W. H. Clarke, Arthur Whiting, Eugene Thayer, and future maverick Charles Ives). But this more symbiotic era would end with Albert SCHWEITZER's refocusing the organ world on "authentic" Bach; the French and German Romantic schools were marginalized, while the American school virtually disappeared. After more than a half-century of aesthetic rejection, Romantic organs have finally gained, notes Williams and Owens, "the status of historical monuments" and are subjected to the kind of careful restoration once limited to earlier instruments; one contemporary Dutch builder, van den HEUVEL, proudly cites Cavaillé-Coll as the model for its neoromantic instruments throughout Europe.

See also **Composers and the Historical Organ**

RICHARD KASSEL

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RÖMER

Austrian organ-building family, also spelled Roemer, Remer, Remmer, or Römmer. The relationships among the family members are unclear. Ferdinand Josef Römer (b. ca. 1657; d. Vienna, 1723) and Johann Ulrich Römer (b. Vienna, after 1650) were probably brothers. From 1683 onward Ferdinand Josef served as organbuilder and calcant to the emperor in Vienna. Johann Ulrich married in 1683 and became a Viennese citizen in 1685.

The two operated a workshop in Vienna together, though they worked independently on some projects. In 1689 the they finished a small organ (2/12) for the Heiligenkreuz Monastery near Vienna; the monastery's two previous organs had been destroyed in a fire, and its financial situation meant that a larger instrument could not be afforded. Contemporary reports stated that the organ met all expectations for a liturgical instrument.

In 1694 a Joseph Remmer (Ferdinand Josef Römer) completed two choir organs for St. Florian near Linz. These two organs with their magnificently carved cases still adorn the choir stalls in the presbytery of the church. Ferdinand Josef built two instruments for St. Stephen's Cathedral, Vienna. The choir organ (1701) was mounted on the rood screen; although the specification does not survive, it is believed the instrument possessed between twelve and fourteen stops. In 1720 he built the main organ (2/32) on the west gallery. This instrument was rebuilt and expanded, probably by Ignaz Kobler (1797; 3/41). Both St. Stephen's organs are lost, the last of their beautiful cases destroyed in 1945.

In 1721 a larger Römer organ was built for the Heiligenkreuz Monastery. The specification of this organ is also unknown, but it must have had significantly more than twelve stops, based on the surviving case, with space for a Hauptwerk, Rückpositiv, and Pedal. The elaborately carved case of the organ was used for a new instrument by Ignaz Kober (1804–06). Soon after its completion Ferdinand Josef still appears in the records as imperial organbuilder. In 1722 Heiligenkreuz received yet another instrument, this time a Hornwerk (a mechanical organ) for its gate tower, apparently built by Ferdinand Josef alone. It contained Principal 16', Posaune 16', Trompete 16', Prinzipal 8', Fagott 8', Koppel 8', Quint 5-1/3', Oktave 4', Flöte 4', Quint 2-2/3', Oktave 2', Quint 1-1/3', as well as a Mixtur 4' and Mixtur 2'. The instrument sounded a C-major triad.

Ferdinand Josef was most likely a more important builder than Johann Ulrich; but little is known about their lives. Unfortunately, very little of their work remains; but what the Römers were doing was significant. The organs of these two men represent the transition from the early to high Baroque in Viennese organ building, from an organ of essentially Principal stops to one including character or "color" stops.

Andreas Josef Römer (b. Brünn [now Brno, Czech Republic], 1704; d. there, 14 July 1750) was active in Brünn near the organ-building workshops of Sieber and Richter. Andreas Josef is not known to have built new organs; he is mentioned only in connection with reparations, specifically as a carpenter and cabinetmaker. Despite this, his work and that of the Sieber and Richter workshops are sometimes collectively referred to as the "Brünn organ-building school."

Anton Römer (b. Brünn, 1724; d. Graz, 14 July 1779), son of Andreas Josef, moved to Graz, where in 1750 he married the widow of organbuilder Cyriacus Werner (ca. 1690–1747). After her death, he married T. Gottier in 1757; after Anton's death she married the organbuilder C. M. Schwandtner. Upon Anton's death, the Römer organ workshop ceased to exist. Anton Römer enjoyed a good reputation; two Römer organs still stand in Croatia (then under Austro-Hungarian control, but farther away from Austria proper). Surviving instruments with at least part of his work include Austria, Wallfahrtskirche (2/19) and two organs in Croatia: Trški Vrh (1765; 2/12; original mostly intact) and Varazdinske Toplice, near Marof (1765; 2/20; partly orig.).

MAX ZWEIMÜLLER

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ROOSEVELT, HILBORNE L(EWIS) (1849–1886)

American organbuilder. Born in New York City on 21 December 1849, Hilborne L. Roosevelt was a member of the prominent Roosevelt family (Theodore Roosevelt was his cousin), a friend of Thomas Edison, and a pioneer in early telephone technology and holder of numerous patents (including the telephone "hook" switch, a variant of which is still in use). He apprenticed with Hall and Labagh; during this time, his personal wealth enabled him to pursue his interest in electricity and its applications. As early as 1868, he patented an electro-pneumatic key action; the following year, he exhibited an organ utilizing this technology at the American Institute Fair in New York. In 1872 he left Hall and Labagh and traveled in Europe, studying the work of major organbuilders there. On his return that same year, he formed the Roosevelt Organ Works with his brother Frank Roosevelt (1862–1895). Their first organ was built on speculation for the family's own church, Holy Communion in New York. Philadelphia's 1876 Centennial Exposition featured a three-manual

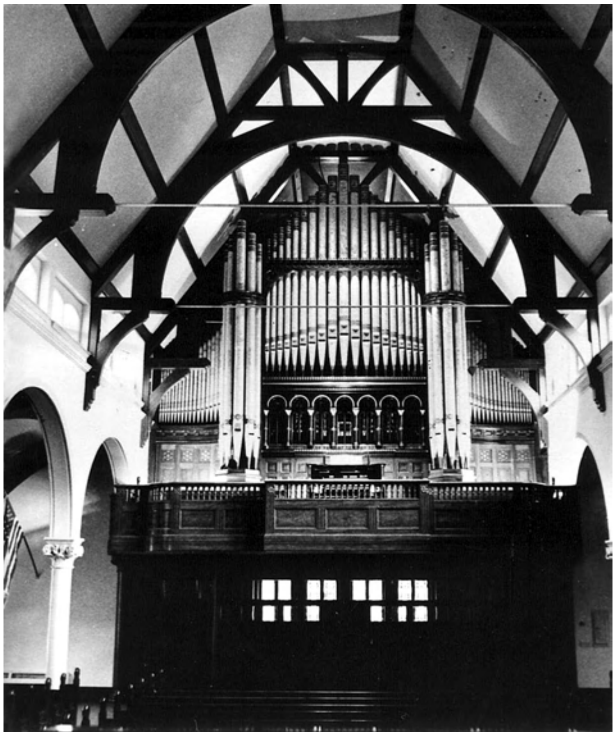

Fig. 67. Roosevelt organ, 1883 (3/60), First Congregational Church, Great Barrington, Massachusetts (case by George Ashdown Audsley).

pneumatic Roosevelt with two electric (separated) divisions and blowers, anticipating the Roosevelts' use of electro-pneumatic action, as well as the first American use of combination pistons.

Although the Roosevelt firm lasted only twenty-one years (outliving Hilborne), it built many, if not most, of the largest instruments commissioned by prominent clients, including New York, Chickering Hall (1875); New York, Grace (Episcopal) Church (1876); Boston, Trinity (Episcopal) Church (1877); Grace Church, New York (1878; connected with 1830 Erben gallery organ); Great Barrington, Massachusetts, First Congregational (1883; 3/60, tub./electro-pneum., hydraulic blower, Audsley case; extant); Garden City, New York, Cathedral of the Incarnation (1885; 113 stops, the firm's largest instrument); New York, First Presbyterian (1887); and the Chicago Auditorium instrument (1892; 105 stops, the firm's second largest). At one point the company had branches in Philadelphia and Baltimore.

Hilborne died suddenly in New York on 30 December 1886, and the company was taken over by Frank. Although he continued on for another six years, Frank lacked Hilborne's technical ingenuity and interest in organ building. During that time, however, the Roosevelt Organ Works built another 178 organs. Its last instrument survives, altered and rebuilt, in New York, All Saints Church. In 1893, Frank closed the firm and sold its assets to Farrand And Votey.

The Roosevelt Organ Works was the leading New York organ concern and probably the most prominent American organmaker from about 1875 until its dissolution. Extant Roosevelt organs, large and small, show a high standard of craftsmanship and engineering, and the use of the finest available building materials. The quality of the firm's work was well above the prevailing standard, even of its best competitors. Tonally, Roosevelt's organs pointed sharply toward the orchestral ideal of the early twentieth century. Larger organs included both a variety of color at unison pitch and generously scaled Diapason choruses, often topped by low-pitched Mixtures with tapered Quint ranks. Smaller organs reflect the growing tendency of the time to stress variety of unison color over ensemble. Great divisions in these instruments, for instance, were usually limited to three unison stops of sharply varied color and dynamic level and a single octave register. Most larger Roosevelt organs have been rebuilt or altered. Those still extant in more-or-less original condition include St. James (1889) and Judson Memorial Baptist (1892), both in New York City. Numerous small organs by the firm are still in service.

In 1893, two of Roosevelt's former employees, German immigrants Oscar Müller and George Abel, formed an organ-building partnership in New York. After building about sixty instruments, the firm went bankrupt in August 1902. A three-manual instrument, Opus 5 (1901), is located at Zion German Lutheran, Brooklyn Heights, New York. Their work was characterized by bold tonal qualities, tubular-pneumatic action, and freestanding cases.

John K. Ogasapian

Stephen L. Pinel

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ROSALES, MANUEL J. (B. 1947)

American organbuilder. Born in New York City, Rosales grew up and was educated in Los Angeles. After seeing the movie *Fantasia*, he became enthralled with the music of Johann Sebastian Bach and with the organ. Rosales served his apprenticeship with Herman L. Schlicker and trained in flue and reed voicing under J. Leland Haggart and Kenneth R. Simpson. He was a service representative in Los Angeles for the Schlicker Organ Company, soon establishing his own company, Rosales Pipe Organ Service, specializing in service and restoration work. The firm was incorporated in 1980 as Rosales Organ Builders, Inc., with Rosales as president and tonal director.

In 1982 Rosales joined Charles B. Fisk and Harald Vogel on an organ study tour of the Netherlands and Germany. This led to his involvement in the completion of the Fisk organ at the University Memorial Church, Stanford University, Palo Alto, California. Other research has included field work with Susan Tattershall in 1988 on antique Mexican organs. Rosales has lectured widely, and is a leader in the preservation of historic organs, particularly the instruments of pioneer Los Angeles builder Murray M. Harris. He served as a consultant for the restoration of the Harris organ at Stanford University and a project consultant for the restoration and reinstallation of a 1911 Harris organ at St. James' Episcopal Church, Los Angeles, and is a technical advisor for the restoration of the organ at the Lord and Taylor (formerly Wanamaker) store in

Philadelphia, the core of which is a 1904 Harris organ of 146 stops.

Rosales has been involved with these recent projects: Seattle, St. James Cathedral, where he built an instrument (1999; 4/36) to complement the 1907 HUTCHINGS-Votey organ (4/53; rest. Marceau and Associates, 1996) already in place, thereby creating the most successful and recorded organ pairing in the United States. He collaborated with GLATTER-GÖTZ Orgelbau in building the instrument for Los Angeles, Walt Disney Hall (2004; 4/73, Frank Gehry case). Rosales is currently involved with two more collaborative projects: Philadelphia, Kimmel Center, Verizon Hall (Dobson, due 2006; 4/126, largest North American tracker organ) and Baton Rouge, Louisiana State University (Glatter-Götz; 4/61).

RICHARD KASSEL

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RÜCKPOSITIV

(CHAIR ORGAN; Fr. *Positif de dos*; Dutch *Rugpositief*, *Rugwerk*; It. *positivo tergale*; Sp. *cadireta*). In German, a "positive organ at the back" of and screening the player from the nave. In the late medieval period it was also referred to as *organum parvum*, *opus minum* (Arnolt SCHLICK) or *tergali positivum* (Henri Arnault de ZWOLLE). It is generally a smaller organ with its own keyboard, placed so that the player must turn around to play it; however, this allows the performer to face the nave and choir (if any).

Originally, the Rückpositiv was simply a POSITIVE (from the Lat. *ponere*, to put or place), completely independent of the main organ, that could be moved around as needed in the church. It is possible that the positive antedates the BLOCKWERK-based main organ (usually found on the western gallery of the church). Starting in the early Renaissance, the positive began to be made part of the main case, a separate DIVISION played on its own manual; the positive chest was fixed behind the organist, facing the nave. In Italy, where the Rückpositiv was less common, Banchieri (1609) called it "organetto da concerti dietro le spalle dell'organista." Its stops ought to be "sweet," Arnault van Zwolle believed.

Combining the HAUPTWERK division with the Rückpositiv became interesting after the "introduction" of the WERKPRINZIP; contrast became now easier between the two. Another kind of contrast is demonstrated by an organ built by Heinrich Compenius I (Fritzlar, Cathedral, 1588–90); here, the Rückpositiv replicates most of the Hauptwerk at an octave higher. In the beginning of the seventeenth century, 8' or 4' pipes were placed in the Rückpositiv to be part of the PEDALITER. Transmission of action between main organ and Rückpositiv allowed the organist to control both organs at the (main) console. Gradually, the Rückpositiv ceased to be a totally separate chest, instead becoming a division within the main organ case, as a POSITIV, OBERWERK, BRUSTWERK, and the like. In Germany, France, and the United Kingdom, among other areas, it became part of or the entire SWELL division. A separate Rückpositiv continued to be built until the very end of the nineteenth century in the LOW COUNTRIES and DENMARK.

FERDINAND J. DE HEN

RUFFATTI

Italian organbuilding family. Brothers Giuseppe Ruffatti (1907–1994), Alessio Ruffatti (b. 1909), and Antonio Ruffatti (b. 1912) opened a shop in 1936 after they had served apprenticeships with Antonio Malvestio of Padua; in 1940, the three established Fratelli Ruffatti in the same city. Following World War II, the firm built important large organs for the Basilica of Our Lady in Fatima, Portugal (1952; 5/119) and Monreale Cathedral in Sicily (1967; 6/109); installations in the United States and Canada followed in the late 1960s. When Antonio retired in 1992, his sons Piero Ruffatti (b. 1943) and Francesco Ruffatti (b. 1945) took over the company, Piero as head of design, Francesco as tonal director.

More than five hundred instruments had been built by the end of the twentieth century for locations in Australia, Canada, Italy, Lebanon, Mexico, Nigeria, Portugal, Serbia-Montenegro, South Korea, and the United States. The firm has also restored eighteen historic Italian organs.

Ruffatti may be best known for its large American installations: Fort Lauderdale, Florida, Coral Ridge Presbyterian (1973; 5/117); Garden Grove, California, Crystal Cathedral, (1982; 5/280+; incorp. 1963 Æolian-Skinner organ from Philharmonic Hall, Lincoln Center, New York); San Francisco, Davies Symphony Hall (1984; 5/147); and Morrow, Georgia, Clayton State College, Spivey Hall (3/79). Large instruments scheduled for completion are Naples, Florida, First Presbyterian, due 2005 (5/96) and Uppsala, Sweden, Cathedral, due 2007 (4/94).

Fratelli Ruffatti makes extensive use of computer-assisted design and builds electro-pneumatic and all-electric actions (larger organs) as well as mechanical actions (smaller organs). All components, including pipes, are made in-house.

ARTHUR LAWRENCE

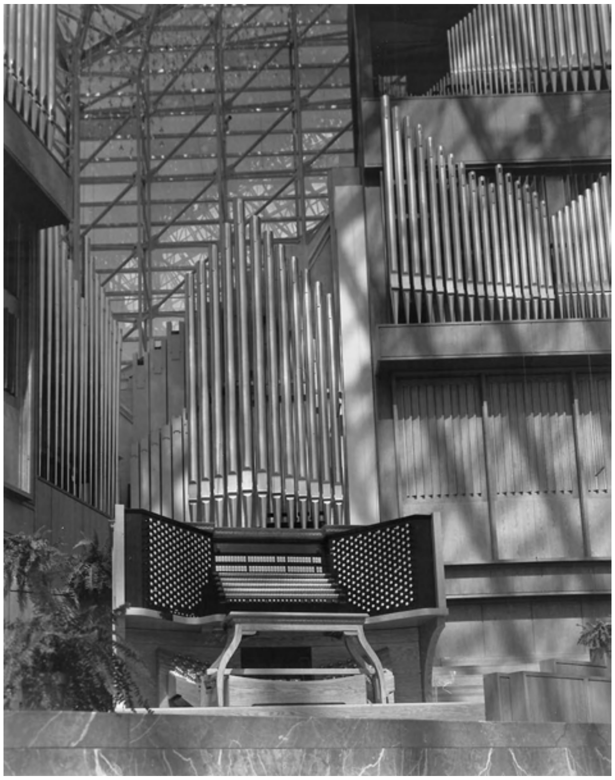

Fig. 68. Uncased Ruffati/Aeolian-Skinner organ, 1982 (2 x 5/302), Crystal Cathedral, Garden Grove, California.

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RUGGLES, CHARLES M. (B. 1949)

American organbuilder. Born in Cleveland, Ruggles observed the inner workings of a pipe organ housed in his family's Cleveland Heights home. He studied piano and organ from childhood on, receiving an organ degree at the Oberlin, Ohio, Conservatory (1971). He apprenticed with John Brombaugh in Germantown, Ohio (1973–75). His influences during his studies and apprenticeship included Jürgen Ahrend, Klaas Bolt, and Harald Vogel. Ruggles concluded his apprenticeship with a tour of Europe in 1975 to play and study organs. Later that year he began building tracker organs under his own name in Berea, Ohio. Originally focused on residence organs, he built his first church instrument for Highland Heights, Ohio, St. John's Lutheran in 1979 (2/18).

Ruggles has continued to build residence organs, practice instruments for academic institutions (Baldwin-Wallace College, Cleveland Institute of Music), portative organs (Ganassi Early Music Ensemble, Burgundian Consort), and organs for churches, notably Grosse Ile, Michigan, St. James Episcopal (1987; 2/11). Most of his instruments are located in the central Midwest.

Martha Folts

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RUN

An air leak within the windchest caused by splitting seams in its construction, often due to changes in humidity, notably excessive dryness. If the separation is located in the vicinity of individual pallet boxes, air directed at one (open) set of pipes may leak into the adjacent (closed) set, causing a cipher.

RUSSIA

In generally, organ music has been positioned outside the mainstream musical tradition in Russia, largely due to the exclusion of instruments from Russian Orthodox religious services. Consequently, the dissemination of the organ began there in a secular sphere, as part of court and popular entertainment. Organ music was known already in Kievan Russia (tenth to twelfth

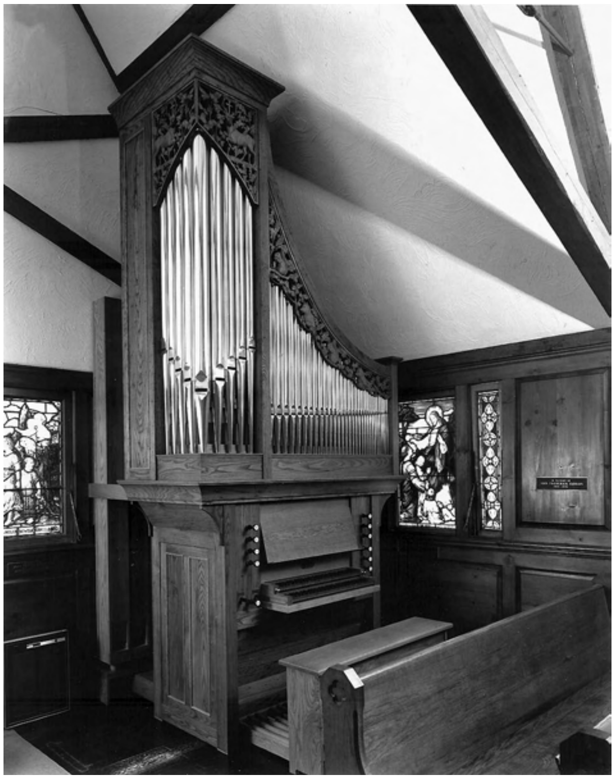

Fig. 69. Ruggles organ, Op. 18, 1988 (2/12), St. Hubert's Chapel, Kirtland Hills, Ohio.

centuries). The Kievan state enjoyed close connections with Byzantium, acquiring its first organs from there. A positive organ with two organ blowers and an organist are depicted on a fresco titled *Skomorokhi* (Minstrels) at the Cathedral of St. Sophia in Kiev, built during the eleventh and twelfth centuries. Minstrels continued to use portative organs, along with other instruments, for popular amusement, through at least the mid-sixteenth century, as documented in the reprimand issued by the church's Hundred Towers Council of 1551: "At secular weddings one can hear blasphemous satirical music makers, organists. . . . When the time comes to move on to the church ceremony, they follow behind a cleric bearing the Cross. These jesters run around him playing their devilish songs, but the clerics turn a blind eye and refuse to upbraid them although they ought strictly to forbid it!"

Moscow, Fifteenth to Eighteenth Centuries

By 1490, the instrument was welcomed to the court of Grand Prince Ivan III, when the organist Johann Salvator came from Italy on the invitation of the prince's brother-in-law, who presumably had a taste for organ music. Another Westerner, the organist and organbuilder Daniel Gottlieb Eilhof, came to Moscow from Denmark in 1578. The court continued to support organ music, purchasing an instrument built in England for the Czaritsa Irina Fyodorovna in 1586.

The first known Russian organ masters emerged during the reign of Czar Mikhail Romanov and, apparently, under his patronage (ca. 1613–50). At the royal palace in Moscow, Russian organists and organbuilders—Andrey Andreyev, Boris Ovsonov, and Melenty Stepanov—joined the Jagan brothers (possibly a Russian modification of "Johann") and Melchert Luhn from Holland as well as Polish masters Yuri Proskurowski and Fyodor Zawalski. The most significant of the seventeenth-century Polish builders, Simon Gutowski (1627–1685) from Smolensk, built a number of organs for Alexey Mikhailovich Romanov (reigned 1645–76). In 1662 a shah of Persia received a Gutowski organ as a present from the czar; ten years later, a new court theater was equipped with another Gutowski instrument.

The number of organs commissioned to the Western European masters increased with the rise of German settlements and Lutheran and Catholic churches in Russia's major cities, during and following the Westernization of Russian culture under Peter the Great (1682–1725). These included a sixteen-stop organ decorated with casework and carved walnut figurines at the top (1619) and an eight-stop organ by Arp SCHNITGER. Around 1715, the czar, impressed by the renowned Gasparini organ in Görlitz, even intended to supply the Metropolitan Church in Moscow with a "monster organ" containing 92 and 114 stops, with specifications by Görlitz organist Christian Ludwig Boxberg; this was among the reformist gestures for which Peter was condemned as an "Antichrist" by the Orthodox faithful.

St. Petersburg, Eighteenth Century

Foreigners, mostly of Germanic origin, continued to dominate in organ building, performance, and composition of organ music throughout the century. However, in 1790 the composer Dmitry Bortnyansky (1751–1825) wrote a Sinfonie Concertante, obviously inspired by Western music, that included a part for *le fortepiano organisé*, (i.e., a CLAVIORGAN); this is considered the first attempt by a Russian composer at incorporating an organ-family instrument. In 1737 the Lutheran Church of SS Peter and Paul received an organ by Johann Heinrich Joachim (1696–1758) from Miltau (now Jelgava, Latvia). The Danish organist Johann Gottfried Wilhelm Palschau (1741–1813) gave an impressive recital the same year. Czarina Catherine II commissioned an organ from the English master Samuel GREEN, probably for her favorite, Prince Potyomkin, toward the end of 1770s.

Although the development of the organ in the Baltic countries and Ukraine constitutes a separate topic from the present discussion (especially with those countries' independent status), various masters worked both in St. Petersburg and in the Baltic, such as Heinrich Andreas CONTIUS, who built an organ for St. Petersburg in 1761. Georg Josef VOGLER, who gave two recitals in April and May of 1788, was impressed by the workshop of Franz Kirsnik (1741–1802), the most renowned organbuilder in Russia at the time. In 1792, the German composer, organist, and pianist Johann Wilhelm Hässler (1747–1822) was appointed to the imperial court; he later moved to Moscow, making an impact with his performances of Johann Sebastian Bach.

The Nineteenth and Early Twentieth Centuries

Amateur organist and composer Prince Vladimir Odoevsky (1804–1869) owned a Georg Mälzel organ from the late 1840s; he called it the "Sebastianon." Mikhail Glinka, "the father of Russian music," frequently improvised on that organ and on the house organ of Vasily P. Engelhardt. Liszt gave an organ recital in Moscow in 1843.

According to Stasov, there were 2,280 church organs in Russia by 1865. Organs were also installed in several theaters in both Moscow and St. Petersburg from 1879 to 1913. A new wave of organ installation now embraced such provincial towns as Nizhny Novgorod, Penza, Samara, and Tula. German organbuilders (Friedrich LADEGAST, RIEGER, Röver, Wilhelm SAUER, STEINMEYER, E. F. WALCKER) as well as the English firm Brindley and Foster supplied newly built instruments. Individual masters of foreign descent, such as Karl Wirth in St. Petersburg, were also active.

The organ began its role in Russian academia in 1862, when an organ department was established at the St. Petersburg Conservatory; the Moscow Conservatory followed suit in 1885. The schools' professors, students, and graduates gave regular recitals not only in their home cities but in the provincial towns of Astrakhan, Kazan', Khar'kov, Odessa (where the Brody Shul, a Jewish synagogue, installed an organ in 1901), and Saratov.

The first organ professors in St. Petersburg were German: Heinrich Still (1829–1886), a graduate of Leipzig Conservatory, was succeeded by Lui Homilius (1845–1908), whose brother Constantin, a graduate of Dresden Conservatory, was organist at the German Reformed Church in St. Petersburg. Tchaikovsky was one of the first students to receive organ instruction at St. Petersburg, Lutheran SS Peter and Paul (Walcker, 1840; 3/63/double pedalboard); another Walcker organ was installed in the conservatory's small auditorium (1897; 3/46, electro-pneum.). Two Ladegast organs were erected in the small concert hall of the Moscow Conservatory in 1885; the larger (2/17) remained there until 1959.

After the 1901 inauguration of the Aristide CAVAILLÉ-COLL organ (1899; 3/50) at the Moscow Conservatory (now in its Great Hall), on which Charles-Marie Widor played, Russia experienced the impact of the French organ tradition. Homilius's successor in St. Petersburg was the Moscow-born Swiss musician Jacques Handschin, a pupil of Max Reger and Widor (1909–20). Guest performers in Moscow included Charles Tournemire (1911) and Marco Enrico Bossi (1907, 1912). Isaiah Braudo (1896–1970), known for his interpretations of Johann Sebastian Bach, and Boris Sabaneev (1880–1918) taught organ at the St. Petersburg and Moscow conservatories, respectively.

Immediately after the revolution of 1917, most organs in Russia were either destroyed or damaged; many were later relocated and renovated. Alexander Goedicke (1877–1957) led the Moscow Conservatory organ class from 1922.

Recent History

Beginning in the 1950s, most new Russian organs were built by the nationalized Czech firm Rieger-Kloss in Krnov. Leonid Roizman took over the organ class at the Moscow Conservatory (1957–1989). A center for organ studies was organized in 1990, and later renamed the Vladimir Odoevsky Organ Center. It sponsored two international organ festivals in 1990 and 1991; the latter, titled The Organ Yesterday and Today, was held in Nizhny Novgorod. In 1996, a small English organ (Henry Jones, London, 1871) was moved to the chamber music hall at the Gnesin Academy in Moscow. In 1997, a new D. A. FLENTROP organ was installed at Kazan' Conservatory.

See also **Lithuania; Poland**

VICTORIA ADAMENKO

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S

SÁ COUTO (LAGONCINHA), MANUEL (MANOEL) DE (D. 1846)

Portuguese builder active primarily around Braga. Sá Couto lived in Ponte de Lagoncinha (S. Marinha de Lousada), where his house, Casa da Bombaça, still stands. A pupil of Domingos de S. José Varela (1762–1834), Sá Couto was one of the most important Portuguese organbuilders working in the neoclassical tradition. Among his most impressive surviving work is a positive at Porto, Church of the Third Order of St. Francis, 1799–1801; a contract for this commission has survived. Other identified work for churches and cloisters include S. Maria Magdalena, S. Tirso (before 1797); Amaria, N. Senhora da Abadia, (1797–98; late Baroque/Rococo; rest. 1958; nonfunctional); Braga, N. Senhora da Vitoría (1807–08; reconstr.; lost) Braga, N. Senhora dos Remédios (1810); Braga, S. Victor (1816); Porto, S. Bento da Avé-Maria, 1817 (moved 1899 by Dos Santos firm); Ponte de Lima, Third Order of St. Francis (1825); and Braga, Bom Jesus do Monte, orig. S. Maria de Bouro monastery, 1833; moved 1855). Sá Couto also built a number of neoclassical organs from 1799 in and around Braga: N. Senhora da Lapa da Arcadia; N. Senhora da Morte, S. Marcos (formerly S. Martinho, Tibães), N. Senhora a Branca, and S. Pedro de Maximos.

Richard Kassel

SALICIONAL

(Lat. *salix*, “willow.”) One of the most common string stops, its tone has varied considerably across centuries and continents. Dating from the late fifteenth century, it was originally rather flutelike in tone. In the seventeenth century the Salicional was a specialty of Hapsburg Europe, from which John Snetzler brought it to England, where it became very popular in the nineteenth century. The German Salicional was a “horny” string, the French variety a quiet Diapason, and the English variety a slightly stringy Dulciana. It is most often found at 8’ pitch, but can also be found at 16’, 4’, and rarely 2’. At 8’ pitch it is often accompanied by the Voix Celeste. The Salicional is almost invariably made of open cylindrical metal pipes, though examples have been made of wood and of conical or even inverted conical construction. The mouths tend to be small; ears are often used to stabilize the speech. A common feature is a roller-beard or harmonic bridge, particularly in the low and middle ranges. The pipes are sometimes slotted, sometimes not. A Salicis Fistula is a “willow pipe,” a rustic flute made from a branch of a willow tree.
See also **Stop**

Edward L. Stauff

SALOMON DE CAUS (CAUX, CAULX) (CA. 1576–1626)

French Huguenot engineer, architect, garden designer, and organbuilder. De Caus was born near Dieppe. He visited several of the greatest Renaissance gardens in Italy (ca. 1595), especially the Villa Medici in Pratolino, near Florence, where he began working for Duke Ferdinando I de’ Medici in 1597. By 1601 (perhaps as early as 1598) he was employed as an engineer at the archducal court of Archduke Albert and Isabella in Brussels, where he designed fountains and grottoes for the royal park, including his first recorded water organ. Around 1609 he moved to London, where he designed two gardens for Queen Anne; after Prince Henry's investiture as the Prince of Wales in 1610, de Caus was appointed his surveyor, collaborating on the garden at Richmond Palace with Inigo Jones, until the prince's early death in 1612. In 1613 he entered the service of Henry's sister Elizabeth and her husband, the Palatinate Friedrich V, in Heidelberg. Here he developed the garden called Hortus Palatinus, known at the time as the eighth wonder of the world, which included a water organ and automated singing birds. Its completion was halted by the exile of Friedrich and Elizabeth (now king and queen of Bohemia) in 1620 at the outbreak of the Thirty Years' War (1620). From 1620 he lived in Paris, where in 1621 he was appointed engineer and architect to King Louis XIII; he died and was buried there on 28 February 1626.

De Caus introduced Italian mannerist approaches to Renaissance garden design to four countries north of the Alps; for their ruling families he designed extensive gardens, hydraulic mechanisms, and automata. In his books, especially *Les Raisons des Forces Mouvantes* (1615), de Caus gave precise descriptions, measurements, and illustrations of the materials and machinery (including essential clockwork mechanisms and hydraulic engineering). In these Mechanical Organs, water not only supplied and regulated the provision of air to the pipes but also rotated a pinned barrel on which the music was stored. De Caus included demonstrations of how to pin a barrel, construct organ pipes with a strong tremulant valve, and tune them in just intonation. His published books also included *Institution harmonique* (1615), on musical intervals and composition.

Fragments have survived of only one of de Caus's gardens, in Heidelberg. He built at least two water organs; they featured some sixty or ninety pipes (two or three registers, using open, stopped, and Rohrflöte pipes), providing a range of three partially chromatic octaves. One of his designs for a water organ was reconstructed in 1997–99 at the Technische Hochschule in Aachen. The garden documented in de Caus's 1620 book, *Hortus Palatinus*, was reconstructed digitally at the European Media Laboratory, Heidelberg, in 2003. Simpler sounds were incorporated in his musical automata, especially for birds whose beaks opened and tails moved, incorporating Vogelsang pipes—imitations of the nightingale and the cuckoo—or whistles.

De Caus's brother Isaac de Caus (b. Dieppe, 1590; d. Paris, 22 Feb 1648) worked in the same field, spending most of his career in England (from 1623 or earlier). His best-known work, the garden at Wilton House, near Salisbury (ca.1632–35), included a grotto with automated singing nightingales.

Hugh Davies

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SAMBER, JOHANN BAPTIST (1654–1717)

German organist, teacher and theorist. Samber (chris. Salzburg, 10 May 1654) received training from Georg Muffat; in 1689 he began to deputize for Hans Jacob Raiff, organist at the Salzburg cathedral and parish. Upon Raiff's death in 1693, Samber received official appointment to those positions. He died and was buried in Salzburg on 19 September 1717.

Samber published three treatises: *Manuductio ad organum* (1704), *Continuatio ad manuductionem organicam* (1707), and *Elucidatio musicae choralis* (1710). His primary significance to organists relates to his detailed description of the 1703 Salzburg Cathedral organ built by Josef Christoph Egedacher and his valuable comments regarding organ registration practices (in the 1707 treatise); these say much about organ practices in southern Germany and Austria around 1700.

Samber recommends the use of all foundation stops (Prinzipal, Viola, and Flutes) either alone or in various combinations. For the plenum he suggests that all the stops could be used if one would omit the Copel (a stopped Flute) and "Spitz-Fleten" (Spitzflöte). Further, Samber makes recommendations (often more than one) for specific genres: Elevation of the Host: Holzflöte or Octav alone; versets: (Wood) Copula (8'), Quinte (2-2/3'), and Decima (1-3/5') or Sesquialtera; or Viola and Cymbel; "toccatiren" (toccatas): (Wood) Copel (8'), Octav (4'), and Cymbel; "fugiren" (fugues): Copel and Duodecima (1'); Copula and Mixtur; Principal, Octav, Quinte, and Superoctav; Copel, Quint, and SuperOctav; Copula, Superoctav, and Cymbel; Copel-Fleten and Duodecima; or Flöte, Quinte, and Superoctav; "concertiren" (performance): Principal alone or with Cymbel; and "phantasiren" (improvisation): Spitz-Fleten alone or with Cymbel; or Flutes with Copel and Viola. Samber, who says very little about reeds, prefers organs with both a weak (*doux*) and a strong (*fort*) tremulant.

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SANDTNER

German organ-building firm. In 1935 brothers Adolf Sandtner I (1905–1977) and Ignaz Sandtner (1909–1982) established the "Orgelbauanstalt Gebrüder Sandtner" in their home town of Steinheim, Bavaria. The small firm's work was interrupted by World War II; both brothers returned, although Adolf was now deaf. From 1948 on the firm built a larger number of new organs in southern Bavaria. In 1967, Adolf's son Adolf Sandtner II (b. 1937) and Ignaz's son Hubert Sandtner (b. 1939) took over the firm, but went their own way a year later. Adolf II took over the workshop in Steinheim; he built some new organs, but increasingly the emphasis was placed on organ maintence. Hubert moved Sandtner Orgelbau to larger quarters in Dillingen an der Donau; it is now one of the leading organ-building workshops in southern Germany. The company has completed over three hundred restorations, reconstructions, and new organs.

Using the south German organ-building tradition as a starting point, Sandtner Orgelbau has sought a style that combines the tonal und technical performance of a traditional organ with modern materials and innovations. Among its new organs are: Munich, Staatliche Hochschule für Musik (1974; 3/49); Eichstätt Cathedral (1975; 4/68); Rottenburg Cathedral (1978–79; 4/61); Villingen, Münster "Unserer lieben Frau" (1982–83; 3/60); Schweinfurth, St. Johannis (1992; 3/56); and St. Ottilien, monastery, choir organ (1994; 2/17). Restorations include: Munich, Residenz, procession organ (attributed to Caspar Sturm, ca. 1600; 1970; 1/3); Schleissheim, Neues Schloss, Anton Bayr organ, eighteenth century (1977; 1/18; orig. Munich, Franciscan Church); Fürstenfeldbruck, Landhofkirche, 1737 Johann Fux organ (1977–78; 2/27); and Weissenau, former monastery, 1787 J. N. Holzay organ (1988–89; 3/41).

Christoph Keggenhoff

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Sandtner Orgelbau. <http://www.sandtner-orgelbau.de/>.

SAUER, CONRAD (1735–1802)

Alsatian organbuilder of German origin; no relation to Wilhelm Sauer (see next entry). Conrad Sauer was born in Undingen, Württemberg, on 7 February 1735. He worked as a cabinetmaker with Johann Andreas Silbermann in Strasbourg, taking the firm over in 1783. His son, (Johann) Conrad Sauer II (b. 20 Sept 1775; d. 5 Mar 1828), took over the historic workshop after his father's death on 2 May 1802. Conrad II's son, Theodor Sauer (b. 11 June 1806; d. after 1863), stayed in Strasbourg until ca. 1833, when the Silbermann workshop nearly went bankrupt; he traveled to Paris and Lyon, where he apparently enjoyed some success. The Strasbourg workshop was taken over by Georg Wegmann (1805–after 1859); however, he was imprisoned in 1857 and eventually disappeared from Strasbourg. Martin Wetzel (1794–1887), a pupil of Conrad II who had been independently active from 1827 and was in competition with the Sauer workshop, considered himself the true heir of the Silbermann-Sauer legacy; his firm lasted until the end of World War II.

In addition to maintaining over ninety J. A. Silbermann organs in Alsace, the Sauer firm's new instruments included Heitersheim (1787; 1/13); Strasbourg, Reformed Church (1789); Kolbsheim (1792); Shiltigheim (1800; 2/20); Valff (1802); Sultzern (1806); Bernardswiller (1808; 1/13); Strasbourg, Magdalena Church (1810; 1/14); Goxwiller (1811; 1/13); Heiligenstein (1813; 1/12); Eckbolsheim (1818); Strasbourg, Clerical Seminary (1826); Waldhambach (1829; 1/11); Strasbourg, St. Ludwig (2/22); and Liepvre (1830).

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SAUER, WILHELM (1831–1916)

Prussian organbuilder. Sauer was born in Schönbeck, Mecklenburg, on 23 March 1831. After his brother Johann Ernst Sauer's early death (1823–42), he became heir apparent to the workshop of his father (Carl Adolph) Ernst Sauer (1797–1873), a self-taught builder whose first instrument was for Schönbeck (1835). After studying with his father, Wilhelm honed his skills with the firms of E. F. Walcker in Ludwigsburg and Aristide Cavaillé-Coll in Paris, then returned to his father's workshop, now in Friedland; together they built an organ for the Marienkirche (1854–55). He established his own workshop in Frankfurt an der Oder (1856) and added a temporary second workshop in Königsberg (now Kaliningrad, Russia; 1860). His organ for Berlin, Christuskirche (1867; eighteen stops) was so successful that his reputation grew nationally and, eventually, internationally. To meet the growing demand for his instruments, Sauer expanded his Frankfurt workshop (eventually selling his Königsberg site). Sauer rapidly became one of the leading Prussian firms, producing nearly twelve hundred organs by 1916. While most of those organs were built for Germany (particularly in the north), instruments were exported to Argentina, Brazil, Ecuador, Finland, Peru, Russia (over forty instruments, 1865–1914), and South Africa.

Sauer organs were known for their symphonic character, precision, technical perfection, and the use of fine materials. Principal stops were very important, but mixtures were used rather sparingly; French influences were increasingly manifest in his string stops, the Flûtes harmonique and octaviante, and reeds; the Pedal of the organ at Frankfurt, Nicolaikirche (now Konzerthalle; 1866–68) has a Quint 5-1/3, Tierce 3-1/5, and Septième 2-2/7 as independent stops. He was among the first to build four-manual organs with over one hundred stops; popularized the cone-valve chest (invented by Walcker in 1840) throughout Germany; and patented a form of combination pedal (1881). He was appointed organbuilder to the Prussian court in 1884. His well-known large organs included Berlin, Thomaskirche (1869; 4/52, tracker); Prague, Rudolfinum (1884); Leipzig, St. Petri (1885); Leipzig, Thomaskirche (1888; reb. 1902, 1908, collab. Karl Straube); Bremen, Cathedral (1894), Berlin, Kaiser-Wilhelm-Gedächtniskirche (1895); Fulda, Cathedral, two organs (1894), and Loja, Ecuador, Cathedral (1892; 2/20; rest. Oberlinger, 1994). In the 1890s, Sauer started building organs with pneumatic actions, although he used cone-chests in smaller instrument. Paul Walcker (b. 1846–1928), who had joined Sauer in 1892 after a dispute at his family's firm, became Sauer's manager and, in 1910, its owner. He was the main force behind the eventual switch to pneumatic actions alone, and began building electric action instruments in 1913. Wilhelm Sauer died a highly honored figure in Frankfurt an der Oder on 9 April 1916.

In 1917 Paul Walcker handed the business over to his nephew Oscar Walcker (1869–1948), who administered both the Sauer and Walcker firms. Walcker hired organbuilder Karl Ruther (d. 1956) to manage the Sauer factory. The two led the firm through the up and downs of World War I, postwar German inflation (when most sales were to foreign clients), and the ascension of the Nazi regime (initially a stabilizing period for the internal German economy, leading to better business for Sauer and others); at its height, Sauer had seven branches in addition to its Frankfurt base. The "declaration of total war" in 1939, however, caused most organ-building to cease. After World War II's conclusion and the Russian plundering and occupation of the Sauer works (to 1946), a former employee, Anton Spallek, returned; Oscar Walcker transferred the firm to Spallek. With considerable effort, Spallek and his associates reopened Sauer Orgelbau, eventually replacing the lost machinery and reestablishing building and restoration efforts. In 1950, the first orders from the new East German government were received.

In 1966, Anton's son Gerhard Spallek succeeded his father. At this time, mechanical action organs, which the firm had begun to build before World War II in response to the ORGAN REFORM MOVEMENT, became an important component of its output. In 1972, the firm was nationalized by the Communist government (VEB Sauer), but its building program went on undisturbed (Wittenberg, Evang. Stadtkirche, 1983; 3/53, mech./electric; incorp. 1811 case). While most of its business went to the USSR and its satellites, countries such as West Germany and Ghana also received instruments.

In 1990, Sauer was denationalized; Werner Walcker-Meyer, grandson of Oscar Walcker, claimed ownership (he was also in charge of Walcker at the time) and built a new factory in Müllrose (Berlin, Cathedral, rest. 1905 Sauer organ, 1988–93; 4/113, pneum. slider-chest). By 1999, both firms were insolvent; in the case of Sauer, Walcker-Meyer resigned, and the firm went into receivership. However, by 2000, a partnership of four experts in their fields (production, technical, sales, and building) had taken over; they continue to lead the firm, which has worked on organs in Weimar, Herderkirche (Rückpositiv added, 1999–2000; 3/53, mech./electric; incorp. 1812 case); Berlin-Wartenburg, Evangelische Kirche, (2002; 2/15, mech./electric); Düsseldorf, Auferstehungskirche, "Felix-Mendelssohn-Orgel" (2004; 3/65); and Skrzatusz (Poland; formerly Schrotz), Wallfahrtskirche "Maria Himmelfahrt," reb. 1876 Sauer organ (in progress; 2/19, mech.).

DOUGLAS E. BUSH

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SAWYER, JOHN W(ILLIAM)

British manufacturer of reed organs. Sawyer (b. Leeds, 28 Mar 1869; d. Chislehurst, 21 July 1907) began building organs at his home in Beeston, Leeds, in 1885 (the firm was also known as Beeston Organ Works). The growth of his business led him to build a large workshop in Leeds in 1889, where he continued operations until his untimely death. The business fell to his father, William Sawyer (d. 10 Nov 1920), a cabinetmaker by trade; upon his passing, his other son Percy Alfred Sawyer (b. 29 June 1876; d. 13 Mar 1952) carried on with the firm until his death. Thereupon it passed into the hands of a cousin who, having no interest in the organ business, liquidated the equipment and work then in progress.

The Sawyer firm is unique in the history of the reed organ, both as to the quality and scope of its instruments and the approach taken in their construction. John W. Sawyer was best known for the larger instruments that he produced. The company originally worked with pipe as well as reed organs, although the pipe organ work was apparently confined to the supply of component parts. In 1900 Sawyer advertised reed organs of between one and three keyboards plus pedal, built on the suction principle. The influence of the pipe organ could be seen in their construction: each instrument's division might have a different wind pressure; great care was taken in voicing the reeds; and ranks generally ran straight through for five octaves without borrowing. Standard reeds and reedboards were used, although oversized reeds were sometimes employed; most came from the United States. The standard methods of voicing involving the twisting, bending, or crimping of the reed tongue were applied with the greatest subtlety; an extremely wide variety of tonal qualities could be achieved by other means, such as varying spacing between the reeds of a rank, providing greater or lesser space into which the reed spoke, employment of reeds of various scales, the application of suction as well as pressure in the same instrument, and the use of two or more reed tongues per note. Qualifying tubes or resonating cavities of various sizes were also used. The bellows was often patterned after that of the pipe organ, and in some larger installations was placed remotely and blown by a water motor.

One of the most notable aspects of the Ideal organ, as it was named by its maker, was that most were built on commission to the specifications of the prospective buyer, and thus each instrument was unique. Sawyer built a large three-manual and pedal instrument in the drawing room of his home. The basic disposition of the stops was:

Division	**No. of Stops**	**No. of Reeds**
Great	22	1,464
Swell	18	1,098
Choir	16	976
Echo (played from Choir)	4	366
Pedal	18	540
Couplers	8	

Promoted as "the largest reed organ in the world," the instrument contained 4,444 reeds in all, winded on pressures ranging from 2-1/ 2" to 15". A prospective customer would play this organ and select the stops he wanted for his own instrument. More typical of Sawyer's work is an organ in the possession of British collectors Phil and Pam Fluke. The specification follows:

Great (Gr)		**Swell** (Sw)	
Soft Flute	4	Clarion	4
Open Diapson	8	Clarinet	8
Horn Flute	8	Oboe	8
Dulciana	8	Clarabella	8
Principal	4	Horn	8
Double Open Diapason	16	Diapason	8
Bourdon1	6		
Pedal (Pd)			
Violoncello	8	Tremulant	
Pedal Bourdon	16	Couplers (Gr – Sw; Sw – Pd; Gr – Pd)	
Posaune	16		

The Sawyer shop was a three-story building devoid of electric power; all work was done by hand, and movement of personnel between floors was accomplished by means of ladders. Large organ components were moved from floor to floor through trapdoors by means of block and tackle. The shop building was still standing as of 1990, the family name still faintly visible on its roof.

James Howard Richards

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SAXONY

The three modern German states named Sachsen (Lower Saxony, Saxony-Anhalt, and Saxony) have never been considered a single region per se, despite the shared names (derived from the invaders who came to inhabit much of Germany). Niedersachsen refers to the lower river basins flowing into the North Sea, where immigrants from the north (modern Schleswig-Holstein) settled. Lower Saxony includes the former duchies of Hannover and Oldenburg as well as the East Frisian Islands. Its largest cities are, Braunschweig, Göttingen, Hannover (its capital), Hildesheim, Oldenburg, Osnabrück, Salzglitter, Wilhelmhaven, and Wolfsburg; Bremen, one of two city-states in modern Germany, is located within its limits. Sachsen-Anhalt, to the east of Lower Saxony, comprises the former principality of Anhalt (at times divided into smaller states) and so-called Prussian Saxony. Its largest cities are Dessau, Halle, and Magdeburg (its capital). To the south is Sachsen, at one time treated as Upper Saxony, later a kingdom buffeted from all sides (Austria, Napoleonic France, and Prussia). Its major cities are Chemnitz, Dresden (its capital), Leipzig, and Zwickau.

Although he was a native of Thuringia, Johann Sebastian Bach, Germany's greatest organ composer, spent at least a part of his lifetime in every Saxon region. In Lüneberg (Lower Saxony, LS), Bach received free education at a Latin school and sang at the Michaeliskirche (1700–02). Then, after appointments in his native Thuringia, where most of his organ music (secular and sacred) was composed (Weimar, Arnstadt, Mühlhausen, and Weimar again), Bach went to Köthen (Saxony-Anhalt, SA), where he enjoyed the position of Kapellmeister (1717–23) under Prince Leopold von Anhalt-Köthen. Bach wrote almost exclusively instrumental music during this period (the prince supported a small orchestra), but none for organ. As cantor at St. Thomas in Leipzig (Saxony, SX; 1723–50), Bach initially focused attention on music for the main churches of Leipzig, as he wrote numerous cantatas and famed settings of the St. John and St. Matthew Passions. He eventually returned to writing organ chorales, notably in the *Clavierübung* III (published 1739), a Lutheran organ mass applicable to church and domestic use. He also rewrote several Weimar-period chorale preludes (BWV 651–668) and composed other preludes (including the "Schübler" chorales, published 1748) and the canonic variations on the chorale "Vom Himmel hoch, da komm ich her" (BWV 769). There were other independent organ works (including the six trio sonatas), but far fewer than in Bach's "virtuoso" years.

The connection between Bach and the Saxon organ world revolves largely around his career as an "organ examiner," inspecting newly completed instruments for satisfactory design and realization. During his career, Bach's reputation was foremost as a great virtuoso; this, plus the intimate knowledge of organ building he had gained from watching Johann Christoph Bach, his uncle (organist in Eisenach), and Johann Christoph Bach, his brother (organist in Ohrdruf), made him ideal for the examiner's job (for pay, including expenses). In the process, he met several well-reputed builders, sometimes as coexaminers, and formed long-term relationships. He also met well-known organists-composers, including Georg Böhm (Lüneberg), J. A. Reincken (Hamburg), and Dietrich Buxtehude (Lübeck, 1705–06), the last during an unauthorized extended "leave of absence" from his Arnstadt position to hear Buxtehude play and likely participate in the famed *Abendmusiken* in Lübeck's Marienkirche. Thus did a relative homebody like Bach (who never left German territory during his lifetime) have the opportunity to visit a variety of instruments, especially in Saxony, Saxon-Anhalt, and Thuringia, and to influence the organ building of his era.

Of the organbuilders Bach knew personally, the best-known were (in chronological order) Georg Christoph STERTZING, Johann Friedrich WENDER, Heinrich Nikolaus TREBS, the CONTIUS family, Johann Georg Schröter, Johann SCHEIBE, Gottfried SILBERMANN, Zacharias HILDEBRANDT, and Tobias Heinrich Gottfried TROST. Of these, Silbermann had the greatest overall influence on organ building. He had studied in Strasbourg (Alsace) with his brother Andreas Silbermann (1678–34), who earlier had worked for the Italian-trained Silesian Eugenio CASPARINI. Gottfried Silbermann, based in Freiberg (SX), applied his "international" background to instruments that exhibited bright Flute stops, strong reeds, and a skillfully voiced blend of sound that still allowed for contrapuntal lines to be heard. Bach gave recitals on Silbermann's instrument in Dresden, Sophienkirche (1720; 2/31) in 1725 and 1731; his son Wilhelm Friedmann Bach was appointed organist shortly before the 1731 recitals; the organ was destroyed in 1945. J. S. Bach gave the inaugural recital on the Silbermann organ at Dresden, Frauenkirche in 1736 (3/43; reb.; destr. 1945). A different sort of connection involves the Wenzelskirche in Naumburg; Bach and Silbermann were the examiners on the new Hildebrandt organ (1743–46; 3/53). This instrument experienced several disposition and technological changes over the following two centuries, but was restored to an original state by Hermann Eule

(1993–2000); some scholars believe it provides the closest available example of what Bach would have wanted an organ to sound like.

But that supposition raises one of many controversial issues regarding Bach as organist-composer: What did he hear, and what did he consider ideal? More important, can we re-create the sound of eighteenth-century German Baroque organs in a useful way, and how do we know we've succeeded? He never designed an entire organ (only suggesting revisions to an existing instrument), did not leave significant registration indications in his scores, and never discussed the subject in writing. To many, Bach's activity in Saxony (more than half of his forty-eight-year career) and relationship with Silbermann have supported the notion that Silbermann's "silvery sounds" (a pun on his name indulged in then and now) are the closest to a Bach ideal that we will ever have. But in the context of the post–World War II authenticity movement, many decided that the north German style of Arp SCHNITGER was a better choice for Bach; on the heels of the Schnitger Conference in Groningen (1969), many builders made it their goal to match older instruments pipe scale for pipe scale, hoping to produce *the* Bach organ. Bach himself did not know Schnitger (who worked in Hamburg-Neuenfelde and was nearly forty years older); but when he traveled to Hamburg (1720), he saw the Schnitger organ at the Jacobikirche (1689–93; 4/60, incorp. Fritzsche/Scherer organs; rest. Ahrend, 1989–93). The position there was open, but Bach left before the auditions. Schnitger built over 170 organs, but only thirty have survived as whole instruments, some of them altered; twelve cases also remain. He built several instruments in Lower Saxony, including Lüdingworth, St. Jacobi, 1683 (3/34, incorp. 1599 Wilde; rest. Ahrend 1981–82) and Norden, St. Ludgeri, 1686–88, 1691–92 (3/46, incorp. de Mare/Evers organs; rest. Ahrend, 1981–85). He built a few instruments for Saxony-Anhalt, including Magdeburg, Kloster Berge (1699; 1/15; sold to Magdeburg-Cracau, Bricciuskirche, 1813; case incorp. in Schuke organ, 1960). Two important instruments for the neighboring city-states are gone: Hamburg, Nikolaikirche (1682–87; 4/67, his largest; destr. 1842) and Bremen, Cathedral (1693–98; 3/50; repl. Schulze, 1849).

Schnitger's organs followed many of his northern European predecessors' traditions: tonally and spatially independent divisions (basis of the modern WERKPRINZIP concept), incorporation of materials from older instruments, and the best possible materials. Like Silbermann, his cases were very individual and well-designed. He was one of the first to build more standardized organs, and sent out assistants from his Hamburg-Neuenfelde workshop to install instruments. But Schnitger's reputation rests on his powerful Principals and mixtures (best for congregational singing), exuberant Flutes and reeds, and Pedal divisions equivalent in range and color to the other divisions. (Some Silbermann organs followed the French Baroque preference for small Pedal divisions.)

Of the other builders previously mentioned, Contius (Halle, SA), Scheibe (Leipzig), and Zacharias Hildebrandt and his son, Johann Gottfried Hildebrandt (Leipzig) had their workshops in Saxony. With one exception, Zacharias (a student of Gottfried Silbermann) built all his instruments for Saxony (ten) or Saxon-Anhalt (four). The style of the two builders is similar enough that at least one Hildebrandt instrument was attributed to Silbermann until the 1970s. Among Hildebrandt's few surviving instruments is the one in Störmthal Dorfkirche, near Liepzig, built in 1722–23 (1/14; rest. Eule, 1934), which Bach examined. Scheibe built an instrument for Leipzig University, Paulinerkirche (1716; 3/53; destr. by East German government, 1968); Bach examined it in 1717 and, after he had become a Leipzig employee, declared it the only organ that met his standards. Bach also examined the Scheibe at Zschortau, Dorfkirche (1746; 1/13, rest. Eule, 2000). The Contius family seems to have had two points of contact. Christoph Contius, whose best-known surviving instrument is at Abbenrode (SA), Andreaskirche (1708), was enlarging the organ at Halle, Liebfrauenkirche Marktkirche (completed 1716; 3/65; case survives in 1984 Schuke organ) at the time Bach was flirting with the idea of taking up the vacant organist's post (1713–14). A more mysterious connection involves Christoph's son, Heinrich Andreas Contius. He and Bach supposedly discussed the design of an organ at Frankfurt an der Oder, Unterkirche (now Konzerthalle) in 1748. After building an instrument at Dieskau (SA), St. Anna (1750), Contius made his way to Latvia, allegedly carrying a "letter of recommendation" from the now-deceased master, and was commissioned to build large instruments in Riga and Liepaja.

The irony for Bach is that, despite his unquestioned ability at and knowledge of the instrument, he never played regularly on an instrument by one of the aforementioned master builders. In Köthen, he played a small instrument (2/13 or 14) in the Calvinist court chapel that did not feature instrumental music in worship; the harpsichord got the bulk of Bach's attention during his Köthen years. In Leipzig, the main instrument at the Thomaskirche was an anonymous 1515 organ, rebuilt by Johann Lange (1598–99, 3/35), which Scheibe maintained during Bach's tenure. The instrument was not replaced until Wilhelm SAUER built a new instrument (1886–89; mech. cone-chests). Sauer rebuilt this instrument twice more (1902, now pneum.; 1908; 3/88; rest. Scheffler and Ullman, 1988–93). To compensate for over two hundred years of Bach neglect, Gerald Woehl was commissioned to build the church's "new Bach organ" (2000; 4/61), based on the Eisenach Stertzing organ designed by Johann Christoph Bach (see above); the case is modeled after the Johann Andreas Silbermann rendering of the Scheibe organ at Leipzig, Paulinerkirche (examined by Bach; see above). The anonymous swallow's nest organ (3/21) in the Thomaskirche was less fortunate; dating from 1489 (moved 1639), it was already in a weakened state when Bach incorporated cameo appearances for it in the premiere of the revised *St. Matthew's Passion* (1736). Sometime in 1740–41 Scheibe dismantled the instrument and took it away, never to be replaced.

Lower Saxony, with its proximity to Hamburg, Schleswig-Holstein and, by extension, Denmark to the east and the Netherlands to the west, retained a more Germanic quality to its instruments, with relatively little French influence and virtually no Italian influence. Saxony-Anhalt and Saxony were somewhat less Germanic in their "organ landscape," and builders like Silbermann brought elements from other schools into the mix. As in much of Europe, organ-building families and/or dynasties passed the craft down through the decades and centuries. In addition to those already discussed, the most active Saxon families and individuals were: Burckhard Dinstlinger (Breslau [now Wroclaw, Poland], ca. 1450–after 1507) and the BECK, RODENSTEEN, SLEGEL, and de Mare families (the sixteenth century); Johann Lange (Kamenz, 1543–1616) and the COMPENIUS family (sixteenth to seventeenth centuries), Gottfried FRITZSCHE (Meissen, 1578–1638), Tobias Weller (Dresden, fl. 1615–51), Jacob Schedlich (St. Joachimsthal [Jáchymov, Czech Rep], fl. 1625–72), Andreas Schweimb (Einbeck, d. 1701), and the Ibach, Kröger, and THAYSSNER families (seventeenth century); Christian Vater (Hannover, 1679–1756), Johann Creutzburg (Duderstadt, 1686–1739), and the Dressel, Caspari(ni), Donati, Gräbner, Tamitius, Trost, and Gloger families (seventeenth to eighteenth centuries); J. A. Papenius (Halberstadt, 1696–1779), J. E. Hähnel (Meissen, 1697–1777), J. C. Müller (Hildesheim, 1704–1799), J. G. Schön (Freiberg, 1706–64), H. G. Bellmann (Augustusburg, 1711–after 1774), Hinrich Just Müller (Wittmund, 1740–1811), and the Hüsemann, Klapmeyer, Friderici, Treutmann, Oehme, Papenius, Pfützner, Schramm, and TRAMPELI families (eighteenth century); J. C. Kayser (Dresden, 1750–1813), J. G. Zöllner (Wermsdorf, 1750–1826), J. A. Hesse (Lunzenau, 1763–1835), and the Rohlfs, Wenthin, Wilhelm(y), Zuberbier, and Bentroth families (eighteenth to nineteenth centuries); J. C. Noack (Braunschweig, ca. 1778–1850), Christian Bethmann (Hannover–Linden, 1783–1833), J. G. Mende (Leipzig, 1787–1850), G. S. Janssen (Aurich, 1802–99), C. F. Göthel II (1804–73), G. H. Nagel (Grossenhaim, 1805–88), F. W. Voigt (Eisleben, 1810–86), Julius Strobel (Bad Frankenhausen, 1814–1884), August von Werder (Höckelheim, 1819–1882), Conrad Geissler (Eilenburg, 1825–97), Carl Böttcher (Magdeburg, ca. 1828–ca.1890), C. E. Schubert (1830–1900), K. T. Stöckel (Dippoldiswalde, fl. 1841–76), F. E. Keller (Ostrau, 1843–1925), Johann Diepenbrock (Norden, 1854–1901), Emil Müller (Werdau, 1857–1928), G. H. Schäf (Freiberg, fl. 1872–1907), and the Heerwagen, Reubke, Herbrig, Euler, Meyer, Kreutzbach, Kröger, Giesecke, and Becker families (nineteenth century); and the Schmid, Krell, Boden, Voigt, Röver, Haupt, Faber, Jahn, Sander, and Hülle families (nineteenth to twentieth centuries).

Saxon organ building began losing its special provincial qualities during the nineteenth century. Most instruments continued to be built by local firms, with occasional contributions by Thuringian builders (Gebr. Poppe, Stadtroda). But major builders such as Sauer (Brandenburg), E. F. WALCKER (Baden-Württemburg), and Euler (Hesse) began to penetrate the Saxon market significantly. The conversion of workshops into factories meant quicker production of instruments, along with increasing uniformity; by the early twentieth century, there had been an almost complete shift to uniform scaling, electric blowers, and electro-pneumatics.

Firms such as EULE Orgelbau (Bautzen, SX; nationalized as VEB Bautzen, 1972–90), Furtwängler and Hammer (Hannover), Jehmlich (nationalized as VEB Dresden, 1971–90), Friedrich LADEGAST (Weissenfels, SA), Rohfling (Osnabrück, LS), Rühlmann (Zörbig, SA), Schuster (Zittau, SX), and Schmeisser (Rochlitz, SA) continued to fill Saxony with their technologically sophisticated Romantic instruments (the "symphonic organ" did not make any inroads here). But the twentieth century saw two world wars, the economic troubles of the interwar period, and national policies that shifted power away from the church and municipalities in favor of a secular centralized government. Although the ORGAN REFORM MOVEMENT began in Alsace, its implications were not immediately realized in Germany; a country dominated by instruments by Walcker, SCHULZE, and other Romantic builders was not ready to give up its tendencies. But the 1950s saw builders beginning to spread its gospel throughout Germany and Europe, and to North America. While the 1969 Groningen conference brought Schnitger into the limelight, the interest in restoration and neobaroque instruments had not begun there: Saxon builders had already shown their eagerness to restore Silbermann instruments to their eighteenth-century glory.

In addition to the firms mentioned above, Saxony's important builders in the twentieth century have included HAMMER Orgelbau (Hannover), Eduard Beyer (Magdeburg), Hans Wolf (Verden, LS), Hans-

Heinz Blößß (Oker, LS), Jürgen Ahrend (Leer-Loga, LS-Frisia; with Gerhard BRUNZEMA, 1954–71), Alfred FÜHRER (Wilhelmshaven, LS), Fleischer and Kindermann (Dessau), Wilhelm Rühlmann (Zörbig, SA), Friedrich Weissenborn (Braunschweig), Ludwig Hoffmann (Betheln, LS), Matthais Kreienbrink (Osnabrück), Herbert Kruse (Lohne, LS), Paul OTT (Göttingen, LS), and the Rühle (Moritzburg, SX), Dutkowski (Braunschweig), Hillebrand (Hannover-Altwarmbüchen), Halberstädter Orgelbau (SA), Hildesheimer (LS), and Schmidt (Hannover) firms; builders from outside Saxony include Karl SCHUKE (Berlin-Zehlendorf), Rudolf von BECKERATH (Hamburg), and Klaus BECKER (Schleswig-Holstein).

Organ building in the three Saxonys, as elsewhere in Germany, was and remains a vital activity, if no longer a prime industry. The competition with electronic organs and digital synthesizers has taken its toll; in Catholic areas, the deformalizing effects of Vatican II are still being felt. But the postwar organ revival has encouraged a growth industry of restoration and reconstruction of Renaissance, Baroque, and (more recently) Rococo and Romantic instruments, not only of altered organs, but of instruments damaged or destroyed by twentieth-century warfare and, even now, those victimized by more extreme Protestant ideologies.

RICHARD KASSEL

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SCALING

The art of pipe scaling consists of determining the physical dimensions of each pipe in a rank in relation to all other ranks within the instrument. Three basic elements of FLUE pipe scale are: the inside diameter of a pipe in relation to its length, its mouth width in relation to pipe circumference, and the height of the cut-up. PIPE diameter determines basic tone quality and intensity; mouth width influences loudness; and CUT-UP height refines tone color. Additional scaling factors that regulate air flow are the size of the TOE hole, the angle of the LANGUID bevel, and the size of the WINDWAY.

The most important scale in an organ is the Great 8' Diapason. Since the Freiburg, Germany, organ conference of 1926, the assumed standard of scaling is a Diapason whose "normal" scale is an inside diameter of 155.5mm at 8' C, halving diameters every major tenth (seventeen notes), with a mouth width one-quarter the pipe's circumference, and a cut-up height of one-quarter the mouth width. This theoretical standard allows for scale description in terms of the number of pipes smaller or larger than the normal scale for that pipe, abbreviated as plus (+) or minus (-) [steps] Normal Scaling (NS). For example, the measurement of an 8' Diapason may vary from +2 to -6 NS. Strings are often -6 to -16 NS, while tapered stops like a Gemshorn or Erzähler are -2 to -8 NS at their larger diameter. Flutes come in a variety of scales, ranging from +2 to -2 NS for open Flutes to -10 to -12 NS for narrow stopped Quintadenas. Mouth widths for strings, mutations, and flutes often range from one-fifth to one-quarter the pipe's circumference.

The earliest treatises suggest that during the ninth to the twelfth centuries a common diameter (or circumference) was used for all pipes within a rank. The measurement was set at the shortest pipe, with pipe lengths extended downward by means of the monochord ratios of PYTHAGOREAN INTONATION. As long as the range was limited to the twenty steps of the Guidonian hand, the resulting scale was workable, albeit with "fluty" trebles and "stringy" sounding basses.

The adoption of scales whose diameters and lengths followed the 1:2 octave ratio (i.e., 2:1) may have begun as early as 1000 CE, although descriptions of the older fixed diameter method persisted in treatises until 1300. The exact reasons for the change are not documented, although there appears to have been a strong tendency to try and relate pipe scales to monochord ratios.

Instruments built between 1500 and 1800 show scaling based on the adoption of one of three procedures: the addition of a small "corrective" constant to the basic 1:2 scale, a fixed-scale construction based upon a simple ratio obtained through geometric construction, or the creation of a variable scale.

By 1500 additive constants were consistently used as a means of improving upon monochord ratios in calculating pipe diameters. This allowed for an extension of keyboard range with increased evenness of timbre within each rank. If the diameter of the lowest C was set at 120mm, the 1:2 octave ratio would produce a scale whose Cs measured 120mm, 60mm, 30mm, and 15 mm along the four octaves of the keyboard. Having established diameters by the same means as musical intervals, we then add a constant amount, say 15mm, to each pipe's diameter to produce a scale of 155, 75, 45, and 30mm. An early example of this type of procedure is seen in data presented in Michael Praetorius's description of the 1361 Halberstadt Cathedral organ (1619). As late as François Bédos de Celles's *L'art du facteur d'orgues* (1766–78) we still find plates of flue pipes scales whose dimensions are derived from a 1:2 scale augmented by a corrective constant. The constant varies between stops, but remains unchanged within each rank.

An alternative to additive constants is scale construction by means of a different fixed ratio. The 3:5 octave ratio is used almost as extensively as the 1:2 ratio. It persisted as a means of generating organ principal scales from 1500 to 1800. Bédos de Celles preferred a 5:7 ratio for most of his reeds but used 4:5 ratio for basses to keep them from getting too large. Salomon de Caus (*Institution harmonique*, 1615) and Athanasius Kircher (*Musurgia universalis*, 1650) describe how this is done through geometric means. Their constructions show the use of squares, triangles, and pentagons inscribed in circles to help derive diameters with 1:[square root of 2], 2:3, 3:5, 4:5, and the golden mean ratios. Marin Mersenne's *Harmonie universelle* (1636) provides a useful account of both old and new scale constructions.

A line of seventeenth- and eighteenth-century north German organ theorists expounded upon a different system of scale construction in writings by Andreas Werckmeister (1681), Johann Philipp Bendeler (1690), and Jacob Adlung (1768). The close relationship of Werckmeister and Bendeler to Arp Schnitger suggest that this may have been the latter's preferred method. The theorists explain that scales are first calculated from the diameter of the lowest pipe according to musical proportions, then adjusted by a reduction of scale in the bass and an augmentation of scale in the treble, the exact amount of alteration being determined by arithmetic or mechanical means.

A significant change in scaling theory begins in the last quarter of the eighteenth century with Georg Andreas Sorge's application of logarithms to pipe scales. His manuscript treatise *Die geheim gehaltene Kunst der Mensuration der Orgelpfeiffen* suggests the octave ratio of 1:2 is inappropriate to the large tessitura of organs then in use, while the alternative ratios of 3:5, 4:7, 5:9, or 9:16 do not permit the doubling of any single number to produce the circumference of another pipe. He suggests the solution lies in the application of logarithms to allow calculation of scales that halve circumferences on either the major ninth, minor tenth, or the major tenth (his preferred method). Sorge's manuscript was copied and put into practice by the American organbuilder David Tannenberg.

Nineteenth-century organ theorist Johann Gottlob Töpfer arrived a scale identical to Sorge's major tenth halving scale through different means. Töpfer derived his scale by taking the geometric mean between 1:2 and 1:[square root of 2], working his scales in cross-sectional areas rather than diameters to enable the easy production of wooden pipes of identical scale. Today the same scale is reckoned according to diameters in the ratio of l:[4th root of 8] (= 1:1.6818). Gradually the idea of halving the diameter at other places evolved. Scales were proposed whose diameters halved on the sixteenth, seventeenth, eighteenth, nineteenth, twentieth, and twenty-third pipes. Generally speaking, the larger the number of pipes it takes for a scale to halve, the more "fluty" the treble. Aristide Cavaillé-Coll's standard practice was to mix different halving ratios within the scale of a single stop. His 8' Flûte harmonique often halved first on the twenty-first pipe, thereafter halving every seventeen pipes. His 4' Prestant often halved every seventeen pipes until g♯, halving next at g'''. His 8' Salicional halved on the twenty-fourth pipe, thereafter halving every eighteen pipes.

George A. Audsley based much of his work on F. E. Robertson's *Practical Treatise on Organ Building* (1897). Audsley remarks that a scale halving on the nineteenth pipe is the limit one may take with principal stops, while the scale that halves on the twenty-first pipe adds fullness to the trebles of certain flutes. He also remarks that scales for string stops vary and benefit from variable scales. Nineteenth-century American organbuilders began to describe scales in terms of a number printed on the largest pipe of a rank. Each builder scaled according to personal own tastes and practices, but referred to the entire scale by number rather than diameter or halving ratio. This facilitated easy discussion of scaling between stops by simply quoting scale numbers instead of diameters and halving ratios.

Early-twentieth-century builders experimented with extremes of scale in order to create new voices such as the narrow-scaled Viol d'Orchestre or wide-scaled stopped flutes. The Freiburg organ conferences of the 1920s sought to return organ building to "classic" dispositions in order to facilitate performance of polyphonic music and investigate Baroque methods of pipe scaling. The result of the conference was the adoption of a theoretical normal scale, based on Töpfer's recommended scale, with the standardization of American scale numbers along the same lines, with scale number 1 at the theoretical diameter of 1 meter, and the normal scale as number 44 at 8' C measuring 155.5mm (6-1/8").

The best way to take scales from existing pipework is to mark off the circumference, mouth width, and cut-up for each of the C pipes in a rank on a scale strip made from a long piece of adding machine tape, which can easily be wrapped around a pipe to obtain measurements. The results can then be tabulated according to whatever means the builder finds convenient. Most pipe supply houses offer builders and interested amateurs a book of common scales.

The history of pipe scaling teaches us that there are infinite variations upon a standard scale. Scaling is but a means to an artistic end. After all the scales have been established, the artistic success of an instrument is as dependent on the artistic intuition and experience of both builder and voicer as it is upon any given scaling method.

See also **Voicing**

Geoffrey Myers

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SCANDINAVIA

From the earliest times, Scandinavian organ building has been closely intertwined with that of other northern European organ cultures. Organs were a feature of medieval Scandinavian cathedrals, such as Ribe, Denmark (DN; late thirteenth century) and Lund, Sweden (SW) and Trondheim, Norway (NR; early fourteenth century). The Nordic Museum in Stockholm houses remains of Swedish organs attributed to the end of the fourteenth century, while a number of pipes survive from a pre-Reformation organ in Hamar Cathedral (NR).

The Reformation promoted the teaching of the congregation through scripture and hymn singing. Vocal music was led by the church cantor, while the organ was initially used only for solo and decorative music; the organist was often a civic musician. The organ became more involved in an accompanying role from the seventeenth century on, becoming more widespread.

From the sixteenth century on, cultural contacts with Germany, Holland, and elsewhere in Europe were promoted at the highest state and church levels. In Denmark, Herman Raphaëlis Rodensteen built a Germanic instrument for Roskilde Cathedral (1535–55). The Netherlandish builder Hans Brebus was appointed organbuilder to Denmark's Frederik II in 1570; he was succeeded by Nicolaus Maass (1603) and Johan Lorentz (1615). Many Scandinavian organists were trained in Germany and Holland. It is therefore not surprising to find instruments from this period with several keyboards, multiple chests, and a well-developed Pedal division.

Central European influences continued into the eighteenth century with German builders such as Joachim Wagner (Trondheim, NR, Nidaros Cathedral, 1739–41; thirty stops; rest. Ahrend, 1993–94), Gottfried

Heinrich Gloger (1710–1779; Kongsberg, NR, 1765; 3/42; rest. Ahrend, 1999–2000), Arp SCHNITGER's associate Lambert Daniel KASTENS (Carstens; ca. 1690–1744; Århus, DN, Cathedral, 1730; 3/43; reb. Frobenius, 1927–29; now 4/89, electric), Johan Niclas CAHMAN (Drottningholm, Leufstabruk, Romfartuna/Uppsala, and Falun, SW) and, a little later, Georg Joseph VOGLER (who served as Kapellmeister in Stockholm and introduced his ORCHESTRION there).

There were a few native organbuilders, all with modest operations, until the beginning of the nineteenth century. Pehr Z. STRAND, who studied with his father and with German builders, took over his father's workshop in Stockholm in the 1820s and built instruments until his death in 1844. Companies such as MARCUSSEN (DN, founded 1806) and Åkerman and Lund (SW, 1860) trained generations of craftsmen builders (such as Marcussen apprentice P. A. Albrechtsen), who in turn provided many village churches with traditional small instruments of excellent quality, characterized by rounded, "singing" flue stops.

The large electric-action instrument was less influential in Scandinavia than elsewhere; as a result, the ORGAN REFORM MOVEMENT had a relatively early impact. By the 1920s, several Danish builders were using mechanical action and other classical principles; by the 1950s, Scandinavia held a position of international importance in organ building for the first time. For example, Theodor FROBENIUS's organ for Queen's College, Oxford (1965), became one of the most influential instruments in the British classical organ revival.

Modern Scandinavian firms offer a great diversity of styles. Instruments based on historical models range from Silbermann "re-creations" in Finland to Aristide CAVAILLÉ-COLL "copies" in Sweden. Notable restorations include the Esajas COMPENIUS organ (1610) at Hillerød (DN), Frederiksborg Castle (M. Kjersgaard and J. Ahrend, 1988). The majority of new instruments, however, are relatively eclectic mechanical action instruments in a loosely eighteenth-century idiom, mostly built for the domestic market. Swedish organ culture experienced a real boost when Hans Davidsson launched the Göteborg Organ Art Center at the University of Göteborg in 1995; the center has sponsored a new restoration of the Morlanda (SW) organ (1604; 1/9; 1999–2001).

TIM RISHTON

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SCHALMEI/CHALUMEAU/SHAWM

An imitative reed stop found at 16', 8' or 4' pitch, with short, narrow, cylindrical resonators with a flaring bell, producing a trumpetlike sound. It is considered a solo stop, light-toned but with a cutting effect caused by reinforced upper partials in close proximity. Like the proto-clarinet it imitates, the Schalmei was popular in the Baroque; it was rarely used in the classical and Romantic eras, but was revived as part of the ORGAN REFORM MOVEMENT.
See also **Stop**

SCHANTZ

American organ-building firm. The Schantz Organ Company, founded in 1873 by Abraham J. Tschantz (1849–1921), initially built reed organs, but began making pipe organs in 1890 and developed a type of fan blower. The direction of the company was passed on to Abraham's sons Edison Schantz (1878–1974), Oliver Schantz (1878–1974), and Victor Schantz I (1878–1974), followed by his grandsons John Schantz, Paul Schantz, and Bruce Schantz, later joined by Victor Schantz II and Jack Sievert. The firm is still in operation in Orrville, Ohio, making it the American organbuilder with the longest-lasting family connection. Following World War II, the company gained national prominence for the first time, building over eleven thousand instruments from 1945 to 1970.

Since its inception, Schantz has continued to pursue a moderate course as fashions in both tonal design and appearance have waxed and waned among organbuilders in the United States. As a result, its instruments reveal a gradual move from one style to another (e.g., from the symphonic organ to the neobaroque organ) rather than abrupt changes over a short period of time. This conservative approach has allowed the firm to earn a solid reputation for reliability and quality work, both tonally and mechanically.

JAMES H. COOK

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SCHARF/SCHARFF/SHARP/SCHERP/ACUTA

A Mixture, named for its penetrating tone. From the mid-fifteenth century on, the Scharf was almost always present in the design of German and Netherlandish organs, with Zimbel-like qualities; it remained in use until the development of the German Romantic instrument in the 1840s. Usually Scharf stops have breaks, consisting of ranks higher or lower than a particular note. Later, the Scharf was associated with subsidiary divisions and included Terz (Twelfth), Seventeenth, or Twenty-fourth ranks (e.g., in the 8' register: 2-2/3', 1-3/5', 4/5'; 4' register: 1-1/3', 4/5', 2/5').

Marco Tiella

SCHEIBE, JOHANN (CA. 1680–1748)

German organbuilder. Born in Zschortau, Scheibe moved to Leipzig (1705), where he most likely apprenticed with Christoph Donati the Elder, before succeeding Christoph Donati the Younger as the university's organbuilder (1713). This position gave him responsibility for maintaining all the organs in the city. From 1726 to 1730 he worked outside his native Saxony, but had returned to Leipzig by 1730, when he examined an organ built by David Alpitsch in Leutzsch. His organ for the Johanniskirche in Leipzig (1742–43; 2/22) was praised by both Johann Sebastian Bach and Zacharias Hildebrandt. It is not known whether Bach had any influence on the specifications of Scheibe's instruments, but Scheibe did a thorough reparation of the St. Thomas organ just before Bach's arrival, and in 1730 revoiced and strengthened the instrument's Posaunenbass 16' in the Pedal. Bach also evaluated the Scheibe organs at Leipzig University, Paulinerkirche (1711–16; 3/53; destr. by East German government, 1968), for which Adam Orazio Casparini had served as consultant; and Zschortau, Dorfkirche (1746; 1/13; rest. Eule, 2000). Scheibe died in Leipzig on 3 September 1748.

Described as a "celebrated" organbuilder by his contemporaries, Scheibe's organs typically have a well-developed Principal chorus with relatively few other 8' foundation stops. The Pedal division normally contained essential foundation flue stops and 16' and 8' reeds, with transmissions of manual stops to the pedal, remarked as being a "new and special invention of the organbuilder." Bach declared Scheibe's Leipzig Paulinerkirche organ to be the only organ that met his standards. Scheibe was the father of Johann Adolf Scheibe, the well-known German theorist and composer.

Douglas E. Bush

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SCHERER

German organ-building family. Jacob (Jakob) Scherer (fl. ca. 1535–71) took over the workshop of Jakob Iversand (fl. 1507–37). Between 1538 and 1552 he carried out repairs on the organ at St. Michaelis in Lüneburg, where he had his workshop. Scherer built new organs for the Ratzeburg Cathedral (1551–63); Alten-Brandenburg, St. Gotthard (?) (1557); Stettin, St. Marien (1557–60); Stettin, St. Jacobi (1564–66); and Magdeburg, St. Jacobi (1568, with Hans Bockelmann). He also carred out repairs and renovations on organs at Hamburg, St. Jacobi; Hamburg, St. Catharinen; Rendsburg, St. Marien; and Kiel, St. Nikolai, among others. He is best known for adding a Rückpositiv to the 1475–77 J. Stephani "Totentanzkapelle" organ later played by Dietrich Buxtehude (Lübeck, Marienkirche; 1557–58; 2/25; destr. 1942). In 1569, he turned over his work in Hamburg to his son-in-law Dirk Hoyer.

Hans Scherer the Elder (ca. 1525–1611), son of Jacob Scherer, was the most famous organbuilder of the family. His activities are first mentioned in 1541, working with his father on the organ at Lüneburg, St. Michaelis. By 1554 he was substituting for his father at St. Jacobi in Hamburg. He established himself as a master builder in Bernau, near Berlin, in 1572. Over the next three and a half decades he built new instruments for Bernau, St. Marien (1572–73); Stendal, St. Marien (1580; described by Praetorius in *Syntagma musicum*, 1619); St. Nikolai (1587–90); Lüneburg, St. Nikolai (ca. 1594; also attributed to Hans Bockelmann); Meldorf Cathedral (1596–97); Brake, Schlosskapelle (1600); Hildesheim, St. Georgen (1605–05), Hamburg, St. Gertrud (1605–07); and Rotenburg, Schlosskapelle (1608). During this period he repaired or renovated organs at Stendal, Unser Lieben Frauen Church; Lüneburg, St. Johannis; Hamburg, St. Catharinen; Hamburg, St. Jacobi; Stade, St. Cosmae; Hamburg Cathedral; Bergedorf (near Hamburg), SS Petri and Pauli; and Lüneburg, St. Lamberti. In addition to his sons, his most prominent pupils were Johann Lange (1543–1616), the teacher of Gottfried Fritzsche, and Anthonius Wilde (fl. 1593–99), best known for an organ at Lüdingworth (now Cuxhaven, Lower Saxony), St. Jacobi (1598–99; 2/19; reb. Schnitger; 1682–83; rest. Ahrend, 1981–82). In 1603 Hans the Elder started relinquishing his work to his sons.

Hans Scherer the Younger (ca. 1570/80–1631), son of Hans the Elder, is first mentioned in 1593, together with his father, regarding their work at Bergedorf. In 1600 he cosigned the Brake contract with his father. From this point on he was always mentioned with his father in connection with work in Hamburg (St. Petri, St. Catharinen, and St. Jacobi). After about 1607 Hans the Younger managed the business largely by himself, doing work on the organs in Immenhausen, near Kassel; Hamburg, St. Jacobi; Husum, Stadtkirche; Lübeck, St. Petri; Lübeck Cathedral; Stade, St. Cosmae; and Itzehoe, St. Laurentius. He also built new instruments for three Kassel churches (Schlosskapelle, 1607–09; Brüderkirche, 1610?; and St. Martini, 1610–12); Tangermunde, St. Stephani (1623–24; 3/32; rest. Schuke, 1994); Lübeck, St. Aegidien (1624–25); and Minden Cathedral (1625–26). Fritz Scherer (fl. ca.1603–1606), another son of Hans the Elder, worked with Hans the Younger in Hamburg.

The Scherers were the most eminent family of Hamburg organbuilders preceding the Schnitgers. The three generations span close to a century of organbuilding that saw Hamburg attain preeminence in northern Europe, a position it held until the death of Arp SCHNITGER in 1719.

DAVID SMIT

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SCHLAG

Silesian organ-building family. Christian Gottlieb Schlag (b. Staschwitz, Saxony-Anhalt, 27 Feb 1803; d. Schweidnitz [now Swidnica, Poland], 10 Mar 1889) apprenticed with the organbuilder Schönburg in Schafstädt, Thuringia; he subsequently worked for firms in Herzberg, Magdeburg, and Jauer (Jawor); in 1831 he took over the Kiesewetter workshop in Jauer. In 1834 Christian Gottlieb and his younger brother Johann Karl Schlag (b. Staschwitz, 30 Nov 1808; d. Schweidnitz, after 1869) moved the company to Schweidnitz and continued working together. In 1869, Theodor Schlag (b. Schweidnitz, 18 Apr 1847; d. there, 2 May 1912) and Oskar Schlag (b. Schweidnitz, 16 June 1848; d. there, 26 Nov 1918), sons of Christian Gottlieb Schlag, joined the firm as partners; the firm became Schlag & Söhne. Oskar founded the Association of German Organ Builders in 1891 and became its first president. In 1900 Schlag & Söhne was appointed royal organbuilders to Prince Albrecht of Prussia. Three years later, Reinhold Schlag (b. Schweidnitz, 1874; d. Pomerania, after 1952) and Bruno Schlag (b. Schweidnitz, 1879; d. Hof, 1952), sons of Theodor Schlag, became partners in the firm. Due to financial difficulties following World War I, the company ceased operation sometime after 1918.

Christian Gottlieb Schlag's abilities and his continual striving for tonal perfection established a fine reputation for the firm. In 1865 he traveled to Hamburg and Lübeck to study the characteristics of those areas' historic organs. Shortly after 1870 he started building cone-chests with suspended or hanging VENTILS (discussed in his essay, "Verbesserung im Orgelbau," in *Urania*, 1875). His son Oskar journeyed to London to study high-pressure stops with Henry WILLIS and later expanded the operation of the family business. In 1888 Schlag und Söhne built an organ for the Berlin Philharmonie concert hall with a free-standing console, seven high-pressure stops, electro-pneumatic action, cone-chests, and eight free combinations. In Silesia they acquired important contracts for Breslau (Wroclaw) Konzerthaus (1898), and Breslau University, Musiksaal (1906). By the beginning of World War I, the firm had produced, rebuilt, or restored one thousand instruments.

Like most builders of the era, Schlag placed a priority on foundation stops, including a Principal chorus on every manual, stopped Diapasons, flutes, strings, and a variety of orchestral reed stops. Larger organs typically had a Hauptwerk (including a Trompete 8'), a Schwellwerk (with Oboe, Vox Humana, or Clarinet reed stops) and a Solo division with reeds such as Orchestral Oboe and Tuba Mirabilis on higher pressures.

Shortly after 1870, Karl Schlag (d. Schweidnitz, 1873) and Heinrich Schlag (d. Liegnitz [Legnica], 1903), sons of Johann Karl Schlag, founded the firm Gebrüder Schlag in Schweidnitz (Schweidnitz, Friedenskirche, 1880–82; 3/54, in old case; rest. Verein zur Erforschung und Erhaltung Schlesischer Orgeln, VEESO, 1991; 3/62). The firm was later managed by Ernst Schlag (b. Profen, 1852; d. Schweidnitz, 1941), nephew of Christian Gottlieb Schlag. This company built primarily small organs for Silesian clients; Ernst's son Martin Schlag also enjoyed some success.

DOUGLAS E. BUSH

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SCHLICK, ARNOLT (CA. 1460–AFTER 1521)

German organist, composer, and theorist. Schlick's use of the German language points to his being from Heidelberg. Blind, possibly from birth, Schlick served as the Palantine electoral court organist from 1486 in Frankfurt am Main; he played to celebrate Maximilian I's election as Holy Roman Emperor (1493). From 1490, Schlick traveled throughout Europe: to the Netherlands, to avoid the plague in Heidelberg (1490–91); to Strasbourg, to hear the inauguration of Krebs' organ for the Cathedral (1491); and to Worms (1495). While not an organbuilder, he tested instruments at Hagenau, St. George (choir organ, 1503; main organ, 1510). He received a lifetime appointment at the Palatine court in 1509; in 1511 Maximilian I granted him the copyright to publish SPIEGEL DER ORGELMACHER UND ORGANISTEN, apparently intended to set standards for builders throughout the empire. The following year he published his *Tabulaturen etlicher Lobgesang* for organ or lute, his only collection of compositions. In 1516 he went to Torgau (Saxony), where he met his great contemporary Paul Hofhaimer; that year he examined an instrument at Neustadt an der Weinstrasse. He is last mentioned on a bill for examining the renovated main organ at Hagenau, St. George (1521) and during that year he sent a collection of organ pieces to the bishop of Trent, including his famous piece composed for ten voices, four of which Schlick indicated could be played in the pedals.

Schlick had an outstanding reputation as organist during his lifetime, but it is his *Spiegel der Orgelmacher* that attracts attention now. It is the first comprehensive organ treatise, presenting an idealized disposition of a two-manual organ (HAUPTWERK and RÜCKPOSITIV, plus a Pedal division) and discussions of scaling, pipe metals, windchests and bellows, tuning, and placement of the organ. He describes a stop mechanism that controls both mixtures and individual ranks, confirming the breakdown of the Blockwerk. He also answers criticism by Sebastian VIRDUNG, a former colleague, published in the latter's *Musica getutscht* (1511). The *Tabulaturen* uses religious models to provide illustrations of Schlick's ideas.

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SCHLICKER

American organ-building firm. Born in Hohentrüdingen, Bavaria on 31 January 1902, Hermann Leonhard Schlicker was a third-generation builder who trained with STEINMEYER and MARCUSSEN AND SON, among others, before emigrating to the United States 1925. After working for the WURLITZER and TELLERS firms, he opened his own business in Buffalo, New York (1930). He died in Buffalo on 4 December 1974; the firm was directed by his son-in-law, Ralph Dinwiddie, until the 1980s; eventually the firm was purchased in 1992 by Matters, Inc.; it ceased operation in 2002.

Schlicker was an eclectic builder; his first small instruments used unification. In reaction to the orchestral organ with its octave-based dispositions, he began following some ORGAN REFORM MOVEMENT trends, reviving the WERKPRINZIP with its detailed upper work. Schlicker developed an electro-pneumatic windchest with expansion chambers in 1950, then started making mechanical key action organs in 1963; upon his death, half the firm's instruments were being built with tracker action. Other patents include a slider-chest pallet-valve and vacuum-operated drawstop action. Schlicker began by building two-manual instruments, adding three-manual organs from 1968; he generally used electric stop action.

Schlicker organs are found throughout North America, especially across the northern United States. Important instruments include Flint, Michigan, Woodside Church, 1952 (designed by Noehren; now 3/58); Fort Wayne, Indiana, Concordia Theological Seminary, 1958 (collab. Saarinen; 2/38; reb. Noack, 1990; Schlicker's first important neobaroque organ); Valparaiso, Indiana, Valparaiso University, 1959 (reb. Dobson, 1994–96); New York, Grace (Lutheran) Church, 1961 (3/74; no nicked pipes); and Lincoln, Nebraska, First-Plymouth Congregational/UCC, chapel (1968; 2/29, unit) and nave organs (1968; 3/50, chancel/antiphonal divisions; dism. 1996–97).

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SCHNARRWERK

See Regal

SCHNITGER, ARP (1648–1719)

German organbuilder. Schnitger was the most important builder in northern Germany when organ building was at its peak in the late seventeenth and early eighteenth centuries. Born in Schmalenfleth, near Golzwarden, Oldenburg, on 2 July 1648, Schnitger learned carpentry with his father (1662–66) and organ building as an apprentice and later journeyman of his cousin, Berendt HUSS in Glückstadt, Holstein (1666–76). Schnitger assisted Huss in building the organ at Stade, SS Cosmae & Damian (1668–73; 3/41; reb. Schnitger, 1688; rest. Ahrend, 1975); he later enlarged it. When Huss died in 1676, Schnitger finished the organ then in progress at Stade, St. Wilhadi. A year later, Schnitger settled in Stade and maintained his own workshop there until moving to Hamburg (1682). Schnitger's largest work, for Hamburg, St. Nikolai (1682–87; 4/67; destr. 1842), established his reputation. This instrument established several elements for Schnitger's larger organs: three 16' Hauptwerk stops; sixteen independent Pedal stops, including seven reeds and two 32' stops (strong Pedal divisions remained a prominent feature of his work); very strong mixtures in all divisions; a wide selection of flutes (although only one rank of narrow open pipes); an almost complete bottom octave in all divisions (compass: C/D-c'''); two manual couplers; three tremulants; and sixteen large wedge bellows. Schnitger kept twelve stops from the previous instrument, and exceeded his contract by five stops.

After he had moved to Hamburg-Neuenfelde, Schnitger's range of activity expanded beyond the Hamburg and Bremen-Verden regions to Berlin, East Frisia, Holstein, Lübeck, Magdeburg, Mecklenburg, Oldenburg, Schleswig, Stettin, the northern Dutch provinces, and the southern Lüneburg area. He sent organs as far away as England, Portugal, Spain, and Moscow. The ALTES LAND had a special significance for Schnitger. He built or rebuilt organs for eight out of the ten churches there, including Neuenfelde (1683–88; rest. Ott, 1978–79), where he became a property owner through marriage in 1684.

Schnitger held a number of exclusive organ-building privileges: in the duchies of Bremen (Bremen Cathedral, 1693–98; 3/50; repl. by Schulze, 1849) and Verden, granted by the Swedish authorities (1699); in Oldenburg and Delmenhorst (1699) and Schleswig and Holstein (1702), granted by Danish kings; and the title of royal organbuilder, granted by Prussia (1708).

The greatest density of Schnitger organs outside the Stade-Hamburg area is in the Dutch province of Groningen. Schnitger was recommended for a substantial rebuild of the large organ in Groningen, St. Martini (1691–92; extant). This work gained him such respect that he was contracted for five more major organs in that city and eighteen organs in and around the province, his last project being the famous organ at Zwolle, Grote- or Michaelskerk (extant). Schnitger died before the organ was finished (buried Neuenfelde, 28 July 1719). His sons Franz Caspar SCHNITGER and Johann Jürgen Schnitger finished the Zwolle project; Franz Caspar later settled there and continued the Schnitger workshop.

Schnitger's fame spread very rapidly, resulting in an unprecedented demand for his instruments that went beyond national or political boundaries and, ultimately, had a significant impact on organ history. His organs were known for their excellent materials and utmost craftsmanship. To meet the demand, he had many students who formed a staff of journeymen to erect organs that to some degree had predetermined specifications. A certain uniformity emerges in his instruments; but, in addition to producing the supply of organs to meet demand, it allowed him to attain a perfection within a single standard that accounts for the high quality and reliability found to his work.

Schnitger built over one hundred new organs, rebuilt around thirty, repaired another thirty, held numerous maintenance contracts, and gave several valuations and rebuilding proposals on several organs. New evidence shows he built even more organs (e.g., Hamburg, St. Georgen, 1707–08; Berlin, St. Sophien, 1714) than those listed by Fock (see Bibliography). Twenty-seven new or rebuilt organs still exist to a greater or lesser degree. The best preserved in Germany are at Hamburg, St. Jacobi (rest. 1993); Hamburg, Johanniskirche (1680; to Cappel, St. Peter and Paul, 1816; 2/29; rest. von Beckerath, 1917); Lüdingworth, St. Jacobi (reb. 1599 A. Wilde organ, 1683; 3/34; rest. Ahrend 1981–82); Norden, St. Ludgeri (1686–88, 1691–92; 3/46, incorp. de Mare/Evers organ; rest. Ahrend, 1981–85); Grasberg, Evangelical-Lutheran (1694; 2/21; rest. Hillebrand, 1980–85); Langwarden (reb. 1650 Kröger organ, 1704–5; 2/20; rest. Führer, 1959); and Weener, Reformed (1710; 2/21; pedal added, 1782, 2/29; rest. Ahrend, 1978–82); and in the Netherlands, at Eenum, Godlinze, Groningen (A-Kerk), Nieuw Scheemda, Noordbroek, and Uithuizen. Other organs are partly preserved; fourteen Schnitger facades survive. Two organs long believed to have been built by Schnitger in 1701 are extant in Brazil: one at Faro (Algarves)

Cathedral, the other at Mariana (Minas Gerais) Cathedral (installed there 1752–53; 2/18/no ped, divided stops; rest. Beckerath, 1978; pull-downs added, 1987; for illustration, see Brazil). Johannes Heinrich Hullenkampf, a pupil of Schnitger, may have been involved in the building of these organs.

Schnitger’s organs strongly followed the North German Werkprinzip (as it was later called), with each division clearly distinguished from the others visually, tonally, and spatially. He usually included a Rückpositiv as a secondary division, a Dutch tradition that had been introduced to Hamburg organ building by Hendrik Niehoff (mid-1500s); Schnitger was among the last builders to use it. Schnitger’s standard “Hamburg facade” presented a polygonal middle tower and a pedal tower to each side with a triangle base joined by four flats. (The Rückpositiv copied the main facade in miniature.) The Pedal division was located in the side towers, sometimes unattached to the main case and positioned lower; in rare cases it would be located behind the main case. His standardized case design allowed for the building of a Brustwerk, even if such a division was not originally planned. While his large German organs all had a strong Pedal division (see above), his smaller Dutch instruments, in keeping with Reformed Church traditions, had either no Pedal or only a pull-down.

In Schnitger’s dispositions, the coherence of Principal stops over a wide range was essential; the Principal pyramid ended in one or more strong mixtures in each division. The dividing up of a large mixture into several stops (e.g., Rauschpfeife, Mixtur, Scharf, Zimbel) had been practiced by the Scherer family. Schnitger’s scaling style differed from the more vocal traditions of Huss and of the Renaissance in its tendency toward a narrower, more brilliant principal scale. Schnitger was fond of fifth-sounding stops. The Sesquialtera, introduced to northern Germany by Gottfried Fritzsche, had a place; flute Tierces did not.

Schnitger’s Pedal reeds were Posaune 16’, Trommet 8’, and Cornet 2’ (4’ in later organs). In larger instruments, he would place two manual reeds, Trommet 8’ or 16’ and Vox Humana 8’, next to each other. A Dulcian was usually used as a secondary division reed, and Friedrich Stellwagen’s invention, the Trichterregal, was employed occasionally. The reeds had little of the singing, round quality of French reeds; they are either strong and majestic, with a rattling yet full-bodied sound emphasizing the bass range, or quiet but characteristic, with numerous partials. Schnitger’s flute ensemble typically comprised the narrow-scaled Quintadena at a low pitch, the wide Gedackt or Holpijp at 8’ pitch, Rohrfloit at 8’ or 4’, and conical shapes at 4’ and 2’ pitch. Doublings of the same flute shapes within one division were rare. Schnitger consistently placed a pair of wooden Flutes at 8’ and 4’ pitch in the Brustwerk.

Schnitger, like Huss, used a pipe organ metal with 23 percent tin, cast on sand and hand-planed, for the heavy pipes, resulting in a lesser thickness in the upper part. Some contracts even called for a tin-lead alloy with 28 percent tin. A higher tin content and the planing technique had been introduced by Fritzsche. To him Schnitger also owed the use of wood for pipes and some new reed stops.

In Schnitger’s smallest organs, the manuals started with a short octave (no C♯, D♯, F♯, G♯, or B), then rose chromatically (c–c’’’); the Pedal compass was CDE–d’. The pitch was set at “Hohe Chorton” (a’ = ±484Hz), about a whole tone higher than modern pitch. The tuning probably depended on local tastes, either the more common “Praetorian” (meantone temperament) or a more modern modified meantone or well-tempered scheme for those wishing to play in more extravagant keys. The rising popularity of these compromise tuning schemes allowed Schnitger to get along without subsemitones (e.g., separate D♯ and E♭), unlike Fritzsche, who had incorporated them. Schnitger built only sliderchests; winding was supplied by large wedge bellows without a separate reservoir; the windtrunks were relatively narrow.

Schnitger built in few couplers, preferring to expose the specific character of each division, rather than combine with others. A push-pull coupler from the upper manual to the next lower one is common, but not even a Hauptwerk-to-Pedal coupler was considered necessary. The pipe arrangement on the chests is laid out in major thirds (the favored Baroque interval) or a whole tone arrangement.

Schnitger represents the summit of an organ-building tradition that had its roots in the Netherlands (Niehoff, Johansen), Hamburg (Scherer), Lüneburg-Münsterland-Oldenburg (Huss, H. Kröger) and central Germany (Fritzsche). His more notable pupils include Rudolph Garrelts (Garrels), J. B. Held, Gerhard von Holy, Lambert Daniel Kastens, Matthias Naumann, and Christian Vater. As independent organbuilders they kept close to the style they had learned in the Schnitger workshop, with the exception of Johann Michael Röder, who pursued a more advanced style. Schnitger was friends with composers (Dietrich Buxtehude, Vincent Lübeck) and contributed to the second edition of Andreas Werckmeister’s *Orgel-Probe* (1698). A learned and deeply religious man, he was a brilliant businessman with a keen sense of the market who managed to prevail over his competitors.

Jürgen Ehlers

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SCHNITGER, FRANZ CASPAR (1693–1729)

Dutch organbuilder of German birth, son of Arp SCHNITGER. Franz Caspar was born on 15 October 1693. He worked in his father's shop and helped to build the organ in Weener (1709–10). After their father's death, Franz Caspar and his brother Johann Jürgen Schnitger (chris. 4 Sep 1690, d. after 1733) completed the four-manual organ for Zwolle, Grote of St. Michaelskerk (1718–21, extant). Although the instrument received much praise, it was also criticized for not being able to combine the Vox Humana with the Quintadena and Baarpijp (a much-favored Dutch registration) and for its use of unequal temperament (after Werckmeister), considered less good than the meantone temperament still widely used in the Netherlands at the time.

While in Zwolle, Schnitger met with "Monsieur Havingha," probably the young Gerhardus HAVINGHA, then organist at Appingedam. After Havingha was appointed organist of the Grote St. Laurenskerk in Alkmaar in 1722, he recommended Schnitger for the rebuilding of the van HAGERBEER organ (1646); the work was completed in 1725. With Havingha's approval, Schnitger introduced many north German characteristics into a monument of seventeenth-century Dutch organ building. The narrow scaling of the new principals and mixtures was remarkable, and, although the Dutch Baarpijp/Quintadeen/Vox Humana combination was retained, the Quintadeen was so altered as to make the end result quite different. The traditional Dutch Cornet was lacking altogether. Although the organ was long thought to have had equal (or almost equal) temperament from the beginning, recent research has shown that meantone temperament was used. The organ has been restored to its 1725 state, retaining only a few later changes (Flentrop, 1982–86).

In 1728, Schnitger signed a contract with the Groningen town council to enlarge the organ at the Martinikerk, which had been largely rebuilt by his father Arp (1691–92; added monumental pedal towers), with a Rugwerk. Schnitger died during the work at Groningen (buried 5 March 1729); the work was completed by Albert Antoni HINSZ, who then married Schnitger's widow in 1732, leading to the merger of Schnitger's and Hinsz's workshops. Later on, Schnitger's son Franz Caspar Schnitger Jr. (b. 15 Nov 1724; d. 12 Nov 1799) joined Hinsz's shop; he continued the business after Hinsz's death.

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SCHOENSTEIN

American organ-building firm with German roots. It was established by Felix F. Schoenstein (1849–1936), a second-generation German organbuilder. His father, Leo Schoenstein (1811–1874), started supplying wood pipes to organbuilders around 1850 in Villingen, Baden, a small village in the Black Forest. This business grew into a full-scale organ-building factory, making primarily ORCHESTRIONS (self-playing organs). These were exported internationally; the firm maintained a sales office in Odessa, Ukraine, with dealers in many other cities. By the 1860s the firm was operated by Leo's eldest son, Lukas P. Schoenstein (1836–1921), with his brothers Karl Schoenstein and Erwin Schoenstein.

Lukas employed two other brothers, the aforementioned Felix and Ferdinand B. Schoenstein (1844–1929); he sent them to San Francisco in 1868 to install two Schoenstein instruments. Ferdinand Schoenstein stayed in San Francisco to establish a sales branch for the Villingen factory. Felix Schoenstein also settled in San Francisco, but with the intention of establishing his own firm. He worked for Joseph Severin Mayer (1823–1909), San Francisco's first organbuilder (1869–77); he became shop foreman, responsible for building several organs.

In 1877, Felix Schoenstein established himself in San Francisco as an independent organbuilder. He started out doing repair work and tuning, then built several mechanical action organs between 1881 and 1904. He would build the entire organ, including wood and metal pipes. The earthquake and fire of 1906 destroyed most of his life's work (parts of two organs are all that survive today) and radically changed the direction of the firm, which now had to concentrate on massive rebuilding and replacement efforts. The sudden need for new instruments could only be satisfied by the large eastern firms. Until their own new organ-building activities could start again (1923), Schoenstein represented several eastern builders; the firm installed the AUSTIN Organ Company's majestic 117-rank Panama-Pacific Exposition organ in San Francisco (1915).

From the 1920s through the 1950s, Schoenstein and Company did a monumental amount of work throughout the seven western states. The firm has had an association with nearly every major instrument in northern California and many of the most prominent ones in the West, including the Mormon Tabernacle organ in Salt Lake City (which it renovated in 1988).

At various times the third generation of Schoenstein organbuilders, Leo F. Schoenstein (1878–1951), Louis Schoenstein (1884–1980), Otto Schoenstein (1892–1969), and Erwin A. Schoenstein (1894–1979) worked for the company. In 1909, after a two-year apprenticeship with Ernest M. SKINNER, Louis Schoenstein joined his father as a partner and the firm became known as Felix F. Schoenstein and Son. Later, Erwin and Otto joined the partnership and the firm now carried the name Felix F. Schoenstein and Sons until 1977. The company, which has remained in San Francisco, built a modern factory in the Mission District in 1928.

In 1977, the company was bought from the family by Jack M. Bethards of San Francisco. His objective was to enlarge activities to a national scope, specializing in instruments based on Romantic tonal principles with electro-pneumatic action. He continued rebuilding activities, primarily on Skinner and other historic instruments. Fourth-generation builder Lawrence Schoenstein, who had been with the ÆOLIAN-SKINNER ORGAN COMPANY for eighteen years, served as artistic director at the reorganized company until his semi-retirement in 1984, at which time Bethards took over the directorship. His brother, Bertram Bethards, rejoined the company in 1977 after many years in other trades. Fifth-generation organbuilder Terrence Schoenstein, who also worked with Æolian-Skinner, is involved with the firm on a consulting basis.

The Schoenstein firm is now the oldest and largest organ factory in the West. Between 1977 and 1990, the firm completed thirty-four new organs and several major restorations, including Washington, D.C., St. Paul's Parish, (4/51). Of particular significance is the new organ for the Conference Center of The Church of Jesus Christ of Latter-day Saints in Salt Lake City (5/130).

Schoenstein builds instruments in an international but strict Romantic style, and has studied Romantic organ-building practices in France, England, and Germany. However, it concentrates primarily in the "American Romantic" organ, an eclectic instrument based on Romantic foundation much in the same way that the "American classic" organ is based on a classical foundation. The firm has developed its own electro-pneumatic system based on the "Expansion Cell" individual valve windchest. Schoenstein has conducted engineering and consulting studies throughout the United States, in England, and in Australia, and has done extensive research activities in both the tonal and mechanical aspects of organ building.

JACK M. BETHARDS

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SCHUELKE, WILLIAM (1849–1902)

American organbuilder. Schuelke (originally Wilhelm Schülke) was born in Konitz, West Prussia (now Chojnice, Poland), on 13 April 1849; he emigrated to the United States in 1866. By 1870 he was working in Ann Arbor, Michigan, for Gottlieb Friedrich GÄRTNER, a former E. F. WALCKER employee. When Gärtner sold his factory in 1871 to become a superintendent for Derrick and Felgemaker, Schuelke went briefly to Dayton, then Hamilton (Ohio), where he patented a ventil windchest in 1873. A brief stay in Indianapolis followed.

By October 1874 Schuelke was in Milwaukee, Wisconsin, in a short-lived partnership with Theodore Steinert; they produced only one instrument. By 1875, he had opened his own shop. Until nearly 1890 he built mostly for German churches in the upper Midwest. He used slider-chests in his smaller organs, but a number of organs, especially larger ones, incorporated the ventil chest he had patented. Most of Schuelke's organs provided mechanical aids to the performer to change stops; smaller instruments had Forte and Piano composition pedals while larger ones often added mechanical or pneumatic pistons between the manuals.

Schuelke's first important contract was for the 1879 organ at Milwaukee, Trinity Lutheran Church. The two-manual, thirty-four-rank instrument (now electrified) incorporated ventil chests and an inverted BARKER LEVER action. The two-manual, twenty-eight-rank organ he built in 1885 for Milwaukee, St. Francis Church—a wealthy and influential congregation—established his reputation in Roman Catholic circles. The organ, still extant, uses ventil chests and has a detached console.

In 1890 Schuelke moved to a larger factory in Milwaukee, and a year later published his major catalog in English, reaching a wider audience. In this decade he entered four more patents: a membrane tubular-pneumatic windchest (1895) and a pneumatic-key valve-box (including a coupler mechanism), stop action (using drawknobs), composition pedals, and crescendo pedal, all designed for this windchest (all 1896).

In later years Schuelke employed several workmen who became prominent in other firms. Henry TELLERS (ca. 1875–9 Aug 1920), and Ignatius A. Tellers, who worked for Schuelke (1888–92), left to work for Felgemaker, then founded the Tellers Organ Company in Erie, Pennsylvania (1906). George J. Weickhardt (b. 6 Feb 1858; d. 15 Feb 1919) worked for Schuelke (1894–95), then on his own before becoming a partner in the Hann-Wangerin-Weickhardt Organ Company (1902). Swedish organbuilder Olof Pettersson Hammarberg (1871–1942) worked for Schuelke (1893–97), then returned to Sweden to take over the family firm in Göteborg after the death of his father, Gustaf Adolf Pettersson (1840–1898). He used a pneumatic system based on Schuelke's design.

Schuelke died at the train station after installing an organ at Columbus, Ohio, St. Mary's Church, on 6 December 1902. He had built some 160 organs in seventeen states from New York west to California, and south to Louisiana. Until the end his tonal designs were conservative, with a Principal chorus that usually included a Great mixture on all but small organs.

ELIZABETH TOWNE SCHMITT

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SCHUKE

German organ-building family. The original firm was established by Gottlieb Heise (1785–1848), who founded the Potsdam-based company in 1820 (Brandenburg, Dom, reb. 1723 J. Wagner organ, 1836; 2/33). He was succeeded by Carl Ludwig Gesell (d. 1809–1867), an employee who had trained with the Haas firm in Lucerne. He collaborated with Carl Schultze on several new instruments (Caputh/Brandenburg, Evangelical Church, 1852; 1/8; reb. Schuke, 1926; reb. Hüfken, 2004; now 2/20, mech. slider-chest). He was in turn succeeded by his son Carl Eduard Gesell (1845–1894), who broadened the firm's market (Constantinople [Instanbul], German Evangelical, 1883; 2/12). When Gesell died childless, his apprentice Alexander Schuke (b. Stepenitz, 14 Aug 1870; d. Potsdam, 16 Nov 1933), who had worked briefly for Sauer, took over the workshop.

For the most part, Schuke pursued the Heise-Gesell tradition of building one- and two-manual instruments, even resorting to the old-fashioned pull-down pedalboard on occasion (as late as 1930). He did not build a three-manual organ until 1923 (Pritzwalk, St. Nikolai; 3/34). Larger instruments began to appear more frequently in his work list: Berlin, Gethsemane-Kirche (1928; 3/60, his largest); Berlin, Heilandskirche (1929; 3/58); Calau/Niederlausitz (1930; 3/38); and Berlin-Moabit, St. Laurentius (1930; 3/34; now Johanniskirche, 3/36). The majority of Schuke's later output remained smaller organs, however. Increasingly, he employed pneumatic and electro-pneumatic actions in larger instruments. However, he was sympathetic to the Organ Reform Movement as expressed by Albert SCHWEITZER and Hans Henny JAHNN, although he died before he could participate fully.

Alexander's sons Karl Ludwig (Alexander) Schuke (b. Potsdam, 6 Nov. 1906; d. Berlin, 1987) and Hans-Joachim Schuke (1908–1979) took the firm almost immediately into the Orgelbewegung era by building mechanical action instruments. The Schuke firm was especially dominant in Berlin and its suburbs; among its numerous instruments were Berlin, Französischer Dom (reb. 1906 Dinse organ, 1935; 3/46; destr. 1944); Brandenburg, St. Katharinen (reb. 1726 J. Wagner organ, 1936; 3/46; not extant); Berlin, St. Bartholomäus (1938; 3/41); Potsdam, Garnisonkirche (1939; 2/14; to Babelsberg, 1952); and Berlin, Emmauskirche (1941; 4/70; destr. 1943). During World War II, the firm returned to making smaller instruments; Hans-Joachim was drafted in 1940 and did not return to Potsdam until 1948. By this time it was clear that the Soviet Union would retain its hold on the eastern sector of defeated Germany (East Germany became a Warsaw Pact nation the following year).

While most of its output was smaller in nature, Schuke built or rebuilt a few larger instruments: Bismark, Evangelical Church (1947; 2/20); Berlin, St. Marien (reb. 1720–22 J. Wagner organ, 1748; 3/57); Magdeburg, Dom (1949; 3/28); and Erfurt, St. Thomas (1950; 2/44; "first stage").

To protect its interests, the firm arranged for an employee, Ernst Bittcher, to form a "silent partner," Berliner Orgelbauwerkstatt GmbH, in West Berlin. In 1953, the brothers divided the assets of Alexander Schuke Orgelbau, Potsdam; Hans-Joachim remained in Potsdam, while Karl Ludwig moved to West Berlin. The two new firms became independent of one another; in 1972, the Potsdam company was nationalized by the East German government, bearing the name VEB Potsdamer Schuke Orgelbau until 1990, when Matthias Schuke, Hans-Joachim's nephew, reprivatized the firm. (It had been managed by Max Thiel from 1976 to 1990.) Today Matthias remains in charge of Alexander Schuke Potsdam Orgelbau GmbH. In Berlin, Karl Ludwig took over the company, renaming it Karl Schuke Berliner Orgelbauwerkstatt; the workshop relocated to Berlin-Zehlendorf. Karl Ludwig retired in 1976, and the firm was converted into a worker's cooperative under the management of Wolfgang Theer; Theer was succeeded by Andreas Schulz in 1994.

The two Schuke firms have remained strikingly successful since their creation over a half century ago. Until 1990, Schuke/Potsdam had a built-in market within the eastern political bloc, as witness the placement of numerous instruments in former bloc nations: Bulgaria, the Czech Republic, Germany, Georgia, Kazakhstan, Lithuania, Poland, Russia, Slovakia, and Ukraine; countries outside the bloc have included Austria, Brazil, Italy, Mexico (Zamora, Michoacan, due 2006, 3/51), Spain, and Switzerland. In addition to new instruments, the firm has restored numerous organs of builders: such as Tangermünde, St. Stephani (reconstr. 1624 H. Scherer; 1994; 3/32); Stralsund, St. Marien, 1659 Stellwagen (1959; 3/51); Blankenhagen bei Rostock (1686 Schnitger/Rasche; 2003; 2/12); Erfurt-Büssleben, Petrikirche (1702 Stertzing; 2002; 2/28); Abbenrode, Dorfkirche (1708 Christoph Contius; 1975; 1/15); Wittingen, St. Stephanus (reconstr. 1738 Gloger; 1997; 2/24); Angermünde, St. Marien (1742–44 J. Wagner; 1968; 2/30); Belzig, St. Marien (1746 J. A. Papenius; 1979; 2/20); Radegast/Elbe, 1848 Furtwängler (1999; 2/10); Schwerin, Dom (1868–71 F. Ladegast; 1982; 4/84); Niederhosenbach (reconstr. 1896 Stumm; 1993; 1/4); and Hamburg, St. Petri (reb. 1955 Beckerath; 2004; 4/64).

The Karl Schuke firm has opened a second workshop in Hitzacker/Elbe, where it makes pipes and other wooden organ components. Like the Potsdam firm, Schuke/Berlin has developed an international clientele, with instruments at Bilbao, Spain, Congress and Music Palace (4/71), Rome, Madonna del Divino Amore (3/50), Seoul, Sejong Cultural Center (6/97), Taipei, National University of the Arts (3/40), Tokyo, NHK Concert Hall (5/90), and Warsaw, Filharmonia Narodowa (3/71), as well as other locations in Australia, Austria, Iceland, Israel, Japan, Korea, Poland, Russia, Slovenia, Spain, Taiwan, and the United States (New Brunswick, NJ, Rutgers University, 3/42). But the German market has dominated Schuke/Berlin's business, with hundreds of organs destined for that nation, including several in Berlin (over 125 instruments), Darmstadt, Düsseldorf, Essen, Frankfurt, Gelsenkirchen, Hamburg, Mulheim-Ruhr, and Wuppertal.

RICHARD KASSEL

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SCHULZE

German family of organbuilders. Hans Elias Schulze (1688–1762) worked in Solsdorf (Thuringia), but none of his instruments survive (Unterwirbach, 1738, lost). Johann (Hans) Heinrich Schulze (1716–62; worked in Nottleben) and Johann Daniel Schulze (1720–85; worked in Milbitz), sons of Hans Elias Schulze, also built organs, although only fragments of Johann Daniel's instruments have survived (Oberweissbach). Johann Andreas Schulze (1753–1806), son of Johann Daniel Schulze, assisted his father and took over the firm in 1780; his instruments at Quittelsdorf (1791; 2/22, altered) and Auleben, St. Petri-Paul (1798; altered) survive, as well as fragments elsewhere.

The fourth (and first internationally significant) generation of Schulze builders is represented by Johann Friedrich Schulze (b. Milbitz, 27 Jan 1793; d. Paulinzella, 9 Sept 1858), son of Johann Andreas Schulze, who began his apprenticeship with Ehle in 1806 (Stadtilm). He began building independently in 1815, moving his workshop to Paulinzella in 1825, where he remained, except for a short period in Mühlhausen; here he built organs for St. Marien (1820; 3/42) and Divi Blasiikirche (1823), replacing the original Bach instrument. Schulze went to Weimar to rebuild the 1812 organ at the Stadtkirche (1824–25, 3/47; repl. Walcker, 1907). There he met the church's organist, Johann Gottlob Töpfer, who had proposed a standard for pipe scaling that would serve many builders in the nineteenth century. Töpfer emphasized foundation stops (which led to a seamless blend with reeds at the expense of the Diapason), higher wind pressure, string stops, and dummy zinc facade pipes. These traits, important in Schulze's German instruments, became more so when the firm entered the British market. Schulze also borrowed from Georg Joseph Vogler by employing free reeds, notably a 32' pedal Posaune in the new instrument at Wismar, St. Mary's (1831–41, 3/56).

Schulze began working outside Thuringia, beginning with Rendsburg, Christkirche (reb. 1714–16 Schnitger organ, 1836; reb. Schuke, 1973); Quedlinburg, St. Benedikt (1836; 3/45); Halberstadt, Cathedral of SS Stephen and Sixtus (reb. 1718 Herbst organ, 1837–38; 4/65; repl. Eule, 1965); Halberstadt, Martinikirche (1837–38; 3/47); Weissenfels, Schloss Neu-Augustusburg (1839); Halle, Marktkirche (1839–43; Demmin, reb. 1819 Buchholz organ, 1840); Heringen, Kirche St. Michaelis (1843; rest. 1992); Langewiesen-Öhrenstock, Liebfrauenkirche (1845; 2/18, mech.; extant); Riga, Reformed Church (1848); Bremen, Cathedral (repl. 1698 Schnitger organ, 1847–1849; 3/61; repl. Sauer, 1894); and Verden-Aller, Cathedral (pl. 1487 Smedeker/1696 Schnitger organ, 1850; repl. Furtwängler, 1916).

Four sons of Johann Friedrich Schulze made up the fifth organ-building Schulze generation. (Heinrich) Edmund Schulze (b. Paulinzella, 16 Mar 1824; d. there, 13 July 1878) became a partner in 1851 and took over the firm (now known as Schulze Söhne) in 1858. The other brothers were Eduard F. Schulze (b. 27 Mar 1830; d. 11 Feb 1880); Oskar Schulze (1825–1878), who focused on acoustical issues; and Herwart Schulze (1836–1908), who built organ cases. Edmund Schulze led the firm into new territory that same year by installing a small instrument at the 1851 Great Exhibition (Crystal Palace, London) at the invitation of Prince Albert (who knew Schulze's work from Germany). The small organ impressed not only with its excellent construction, but a warm, powerful chorus and striking Solo manual (including a metal Lieblichgedeckt). The instrument used a concave pedalboard that would lead to the Wesley-Willis concave/radiating pedalboard.

The success of the 1851 exhibition instrument (now lost) led to several important commissions for the firm, and Edmund Schulze supervised most of this business. After a renovation project at Leeds, 1859 (collab. Hill; reb. Harrison and Harrison, 1914; rest. 1997; now 4/82), he altered the British organ landscape with a new organ at Doncaster, St. George's, 1862 (4/94), with its sophisticated system of ventils and borrowings that allowed registrations to be set by the organist and activated simply by changing manuals or opening a ventil. He then enlarged the 1688 B. Smith/1849 Robson organ at London, Temple Church in 1862 (3/47; destr. 1941). A three-manual organ was installed at Tyne Dock, St. Mary's (1864; to Ellesmere College, Shropshire, 1980).

Schulze's next British project involved a large residence organ in Meanwood (Leeds) (1866–69; 4/55). The owner sold the instrument; the purchasers loaned it to St. Peter's, Harrogate (1877). After controversy over its status, the organ finally found a home at Armsley, St. Barthomew's (1879). By this time, Edmund Schulze had died, so his brother Eduard assisted Brindley and Foster in the reinstallation (electro-pneum. action installed, 1976; rest. Harrison and Harrison, 2003; now 4/57). Eduard then built a second instrument for St. Peter's, Harrogate (1879; 4/60, electro-pneum.; rest. Wood and Son, 2001–02). This is usually considered the last Schulze organ.

In Germany, the Schulze firm continued to build for churches, notably: St. Marien, Lübeck (1853–54; 4/78; second German organ with Barker lever; destr. 1942); Burgsteinfurt, Kleine Kirche (1856–57; 2/13; destr. 1945); Soest, St. Petri (1865; Düsseldorf, Tonhalle, 1866; and Etzelbach, 1869; 2/13). Schulze also built organs in New York, New Orleans, Rio de Janeiro, Rome, and Pest (Reform Synagogue, 1858–61; destr. during World War II).

The Schulze organ typically had great 8' tonal variety, the essence of a Romantic organ. The instruments were praised for the masterful blending of ranks and subtle coloring of the Diapasons. They retained classical elements, with well-represented mixtures and mutations; a single manual was usually devoted to the "experimental" elements. Initially, the large windchests were matched with light-pressure voicing; but a growing taste for thicker registrations led to increased wind pressures, often at the expense of balance and tone; Edmund Schulze himself warned of this problem. Nonetheless, by the time the firm closed in 1880, Schulze had helped define the Romantic instrument, and had considerable influence on English and German builders.

Richard Kassel

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SCHUMACHER

Belgian organ-building firm. Stefan Schumacher (1923–2002), who started out as carpenter with Luxembourger organbuilder Georg Haupt, learned organbuilding from and worked with Stahlhut (Burtscheid, Germany) and Verschueren. In 1957 he established Schumacher Orgelbau in Baelen, concentrating on making mechanical slider-chest organs from the outset. He developed a varied program of small organs, still among Schumacher's offerings. The firm's instruments include those at St. Vith, Belgium (1969; 3/39) and Middlesborough Cathedral (1987; 2/18).

His son Guido Schumacher (b. 1957) studied musicology, art history and organ; Guido apprenticed with his father and with Weimbs Orgelbau, and started working for the family business in 1984. Under his leadership, restorations and reconstructions were more important than before, although new organs were still being built. The artistic orientation of the workshop has always been the French classical school; in recent years, a well-considered stylistic expansion based on this tradition has arisen.

Recent Schumacher organs (in Belgium unless indicated) include: Bastogne, St. Pierre (1989; 3/40); Itami, Japan, Sun City Hall (1993; 2/29); Esch-sur-Alzette, Luxembourg, Conservatory (1995; 3/29); Sint Truiden (1996; 3/43); Reckange-sur-Mess, Luxembourg, St. Aldegundis and Quirinus (1995–96; 2/20); and Merzenich, Germany, St. Laurentius (1997; 2/30). Restorations include Liège, St. Jacques (reconstr. Niehoff organ, 1995–98; 3/35); St. Truiden, Onze-Lieve-Vrouwkerk (rest. anon. 1600 organ, 1994–96; 3/42); Hasselt Cathedral (reconstr. anon. 1592/1796 organ, 2002; 3/33); Brussels (reconstr. 1681 Noelmans organ, 2003; 2/24); and Liège, St. Bathélémy (rest. 1844 Merklin/1890 Schijven organ, 2004; 3/40).

Christoph Keggenhoff

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SCHWARBROOK, THOMAS

See Swarbrick, Thomas

SCHWEBUNG

See Celeste/Céleste/Schwebung

SCHWEITZER, ALBERT (1875–1965)

German-born philosopher, theologian, organist, Bach scholar, and authority on organ building and design. Schweitzer, born in Kayserberg, Upper Alsace (now Haut-Rhin, France), on 14 January 1875, became a doctor of medicine in order to further his humanitarian ideals; he became internationally known for his efforts in French Equatorial Africa (now Gabon; from 1913 on), and won the Nobel Peace Prize in 1952. Schweitzer died on 4 September 1965 at his hospital in Lambaréné, Gabon, and was buried there.

Before devoting himself full-time to his medical work, Schweitzer was instrumental in starting the Alsatian Organ Reform Movement, triggered by his "The Art of French and German Organ Building and Playing" articles (1905–6); the activity generated by Schweitzer and others led to the central European reform movement of the 1920s and beyond. The aim of this movement was to review the technique of seventeenth- and eighteenth-century organ-building practices, today considered necessary for an authentic interpretation of organ music of the Baroque period, especially that of Bach and his predecessors.

Schweitzer advocated the preservation of seventeenth- and eighteenth-century organs exemplifying these principles, as well as the building of new ones along the same lines. He strongly supported the philosophy that mechanical action was best for this purpose because of the intimate control the organist had over his or her playing. He wrote, "It is true that the mechanical action costs a good deal more than the pneumatic, but it is better to dispense with one or two stops and have the mechanical action." Schweitzer also believed in low WIND PRESSURE (which improved tone quality) and an unenclosed RÜCKPOSITIV on every organ (to project the sound into the body of the church). Intriguingly, of the organs generally available at the turn of the twentieth century, he favored those built by Aristide CAVAILLÉ-COLL over German instruments for the performance of the works of Johann Sebastian Bach.

Schweitzer advocated a return to the use of the construction of MIXTURE stops as they were in Bach's time. By 1927 organ building had begun to move toward a radical point of view in these matters; he always suggested caution and a middle-of-the-road approach to these changes. His most significant contribution may well have been the 78-rpm recordings he made of Bach (recorded in England, 1935–36). However dated the recordings may sound now, they were the first significant aural record of the new "old" organ. Schweitzer's lyrical studies on Bach focused on the Lutheran chorale as the starting point for understanding the composer's heart and mind, and therefore work; he was among the best non-theoretical writers on the German Baroque master.

For Schweitzer, his approach was "the way back to an organ that is rich and beautiful in tone and interpretation of literature. It is a matter of getting, for the available money, an organ which sounds best instead of one that makes a grandiose appearance. When artistic competition takes precedence, organbuilders will arise who will build an excellent and artistic organ which will be capable of the interpretation of the old masters as well as modern works."

J. J. KEELER

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SCHWIEGEL

A soft Flute stop of 8', 4', 2', or 1', formed of cylindrical metal pipes, each surmounted by a conical section, similar to the Spillflöte; also spelled Schweigel and Schwegel. Other pipe forms have been cited, including conical, double cones, and overblown (harmonic). The stop dates from 1550 in south-central Germany, and its name has been traced to the middle-high German *suegela* (flute; Suavial).

See also **Stop**

EDWARD L. STAUFF

SCHWIMMER

A small RESERVOIR (or, in German, a type of *Balg*, bellows), located at the bottom of a WINDCHEST to provide steady WINDING without the space requirements of a conventional reservoir. The need for large reservoirs has diminished with the advent of electric BLOWERS able to provide sufficient and constant wind pressure. The schwimmer absorbs small disturbances in air such as caused by a sudden chord on full organ, but should not be confused with the CONCUSSION BELLOWS, which is merely a shock absorber.

A schwimmer regulates wind at the last possible moment, before it enters the pipechest. It is diaphragm-like, able to move up and down, and is kept in check by a rhombic pantograph arrangement with a horizontal constant tension spring. Schwimmers are particularly suited to smaller instruments, but can be difficult to design well. Conventional tremulants cannot operate at the same time, as the schwimmer compensates for all pressure changes; some way of oscillating the schwimmer is necessary, for example, the pneumatic flip-flop solution (see Forsyth-Grant). More to the point, builders such as Fisk have opposed its use in that its very purpose contradicts a desire for a more flexible, less steady winding.

ALASTAIR DISLEY

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SEPTIÈME

SEE TWENTY-FIRST/SEPTIÈME

SERAPHINE

A REED ORGAN (also called the Royal Seraphine) invented by the Englishman John Green, a former traveling representative for the Clementi pianomaking firm. Green, who had a shop in Soho Square, London, brought out his instrument in about 1830; he advertised the Seraphine as a new instrument with a royal patent the following year. In his *Concise Instructions for Performance on the Royal Seraphine or Organ* (1833), the instrument is identified as a free-reed organ of the pressure type. The Seraphine was probably influenced by the Viennese Anton Haeckel's Physharmonica of 1821, which was brought to England in 1826; in 1828 a similar instrument named the Aeol-Harmonica was played at a Philharmonic concert.

The Seraphine was built in the shape of a small table 2’ 10” high, 3’ 5” wide, and 2’ 8” deep. It had a range of five octaves (FF-f ‘”) controlling a single rank of reeds. Two pedals were provided, one to operate the bellows and the other a primitive swell pedal to raise or lower a panel placed over the upper portion of the case. The instrument could in this limited sense be said to have expression, as opposed to the harmonium, in which air pressure was varied. Tonal variety was made possible by placing strips of different materials over the reeds. The bellows was weighted in a manner similar to that of the pipe organ and thus provided a steady pressure.

Samuel Wesley, noted organist and composer and father of Samuel Sebastian Wesley, was hired by Green to give weekly concerts on the Seraphine at his shop in Soho, where the instruments were sold. Despite such promotion, musicians found the Seraphine’s tone harsh and strident, and it never found wide acceptance with sensitive players. It did enjoy wide distribution, however, having been introduced to the Isle of Jersey in 1834 by H. Hutton, an instrument dealer in St. Helier, and appearing in advertising through 1836. In the *British Press Almanac* of 1842, a notice appeared that Seraphines were being manufactured in the Channel Islands by J. Bisson, organbuilder and cabinetmaker, who offered them for sale at 50 percent below London prices. In 1841 an improved Seraphine called the Organo Harmonica was introduced by W. E. Evans. This instrument utilized voiced steel reeds and had coiled springs in the reservoir, resulting in enhanced rapidity of articulation at low pressure as well as the augmentation of tonal power as the reservoir filled. The Seraphine is mentioned in patents taken out in 1839, 1846, 1850 (by the French piano maker Jean-Henri Pape, 1789–1875), and 1852 (by Jonathan Caldell Blackwell). By this last date, the instrument had been superseded by the true harmonium. Later in England the term Seraphine was applied to any free-reed organ operating on the suction principle.

James Howard Richards

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SERAPHONPFEIFE

A large-scale open metal Flute with two mouths placed adjacent to each other, as shown in the first illustration (by George A. Audsley). This stop was invented by Wilhelm Theodor Friedrich Weigle (1850–1906) or possibly his father, Carl Gottlieb Weigle (1810–1882). Weigle also made a wooden form, with the two mouths on adjacent sides, rather than on opposite sides like the Doppelflöte. This wooden type is shown in the second illustration (by J. I. Wedgwood). Weigle reportedly invented a number of other “seraphon” stops, both flues and reeds, all of which spoke loudly on high pressure wind, including the Seraphongedeckt, Seraphon Prinzipal, Seraphon Violine, Seraphon-Octave, and Seraphon-Gamba. The name probably derives from the Hebrew word *saraph* (“to burn”), a reference to the biblical “flaming angels.”

See also **Stop**

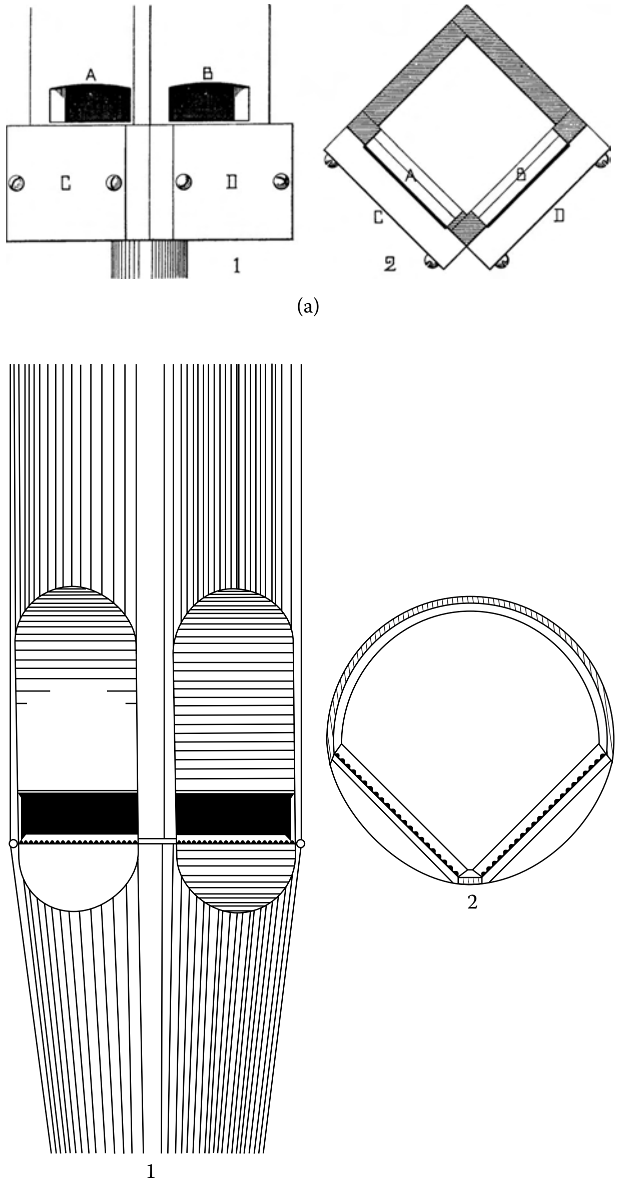
Edward L. Stauff

SERASSI

Italian family of organbuilders. After settling in Bergamo around 1720, Giuseppe Serassi I (“il Vecchio”; b. Como, 1694; d. Crema, 1 Aug 1760) set up a workshop. He is known primarily for his organs at San Pellegrino, Lodi, and the sanctuary of the Madonna de Caravaggio. Andrea Luigi Serassi (b. Bergamo, 19 May 1725; d. there, 1799), son of Giuseppe, continued the firm and built organs in the cathedrals at Crema, Fossano, and Parma. He was also a composer of sacred music.

According to the “Catalogo degli organie fabbricati da’ Serassi de Bergamo” compiled in 1815, the firm had built some 345 organs throughout Italy; the catalog’s compiler, Giuseppe Serassi II (“il Giovane”; b. Bergamo, 16 Nov 1750; d. there, 19 Feb 1817), son of Andrea Luigi Serassi, built many of the more important instruments. He built organs for S. Alessandro in Colonna, Bergamo (1782), S. Annunziata, Como (1800), and S. Eustorgio (1812) and S. Tomaso (1813), both in Milan. In 1808 he published *Descrizione ed. osservazioni pel nuovo organo nella chiesa posto del SS. Crocifisso dell’Annunziata di Como*, which also contains instructions on using various stops.

Following Giuseppe’s death, his sons Andrea Serassi (b. Bergamo, 1776) and Carlo Serassi (b. Bergamo, 1777; d. 1849), and their sons continued the firm through 1895, changing its name to Fratelli Serassi. Carlo was the more important figure, building organs for the Scuola Grande dei Carmini, Venice (1822) and Santa Caternia, Bologna (1828); he completed a second Serassi catalog (now numbering 508 organs) in 1834. The Serassis also took a strong interest in



(a)

(b)

Fig. 70. Seraphonpfeife.

restoration; their work in this area included the Antegnati organ at Brescia, Duomo Vecchio (1824); Trent, S. Maria Maggiore (1826–30); Piacenza, S. Maria de Campagna (1838), Milan Cathedral (1842), Mantua Cathedral (1851), San Marino, Basilica (rest. 1819 Serassi organ; 1858; 2/41/pull-down); and Florence, S. Lorenzo (1865). By 1884, the Serassi firm had built 897 organs.

The organs of the Serassi family retained many features of the classical Italian organ: often only one-manual spring-chests, very few full-length reeds, a strong basis of Chorus stops, and the traditional ripieno. However, the nineteenth-century instruments saw the addition of Romantic stops and effects to Serassi specifications.

Tomas Cimarusti

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SERVOPNEUMATIC LEVER

See Willis Floating and Fisk Servopneumatic Levers

SESQUIALTERA

A compound stop; *sesquialtera* means, literally, “one and a half” (ratio 3:2). It differs from other compound stops by comprising two unbroken ranks of pipes of the Principal type, a fifth (2-2/3’), and a third (1-3/5’). In some cases the Sesquialtera consisted of three stops: an octave (4’), a fifth (2-2/3’), and a superseded third (1-3/5’); even more rarely, by four stops: an octave (4’), a fifth (2-2/3’), another octave (2’), and a superseded third (1-3/5’). (In the last case the Sesquialtera is the same as the Scharf.) In older organs, the Cornetto (Zink) corresponds to the stop later called Sesquialtera, although the pipes were usually rather large Flute stops.

See also **Stop**

Marco Tiella

SEUFFERT

German organ-building family. There were two branches, in Würzburg and in Kirrweiler. After his apprenticeship, Johann Philipp Seuffert (1693–1780), established himself in Würzburg in 1722, became court organbuilder in 1731, and was soon the most important builder in the region. He built more than two hundred instruments of high quality. his son Franz Ignaz Seuffert (1732–1810) took over the workshop in 1768; Franz Ignaz was in turn succeeded by his son (Johann Philipp) Albert Seuffert (1763–1834) in 1789. Shortly after Albert’s death, the Würzburg branch came to an end.

Johann Ignaz Seuffert (1728–1807), another son of Johann Philipp Seuffert, trained with several German and French masters; he established a workshop around 1770 in Kirrweiler, creating the Palatinate branch of the family. His style of organ building had a lot in common with his father’s style; both built mainly one-manual instruments that, much like their few two-manual organs, stand out by a rich range of 8' tone colors, among them the undulating Piffera. The two-manual organs have up to thirty stops, the single-manual instruments up to seventeen stops; one manual was the standard size in the smaller parishes and could, using their 8' base, be extended up to two Mixtures; the Pedal had between fifteen and eighteen keys and only around three stops.

Characteristic of the central German style of Johann Philipp Seuffert are manual specifications without reeds, and Mixtures with thirds and, occasionally, detached consoles. Johann Ignaz mixed Germanic with French elements, and included manual reeds. After his death, his son Franz Seuffert (1773–1855) continued running the workshop successfully, working together with J. W. Ubhaus and C. Wagner. From 1850 on no new organs were built; Franz's son Johann Franz Seuffert (1814–1886) only carried out repairs. Upon his death, the Kirrweiler workshop ceased operations entirely. A number of valuable instruments are still preserved from the different generations of this organbuilding family.

CHRISTOPH KEGGENHOFF

SEVENTEENTH

A mutation foundation rank, generally a Principal of spotted metal, located at 1-3/5' pitch on the manuals—between the Fifteenth (2') and Twenty-second (1')— or 3-1/5' in the pedal (between 4' and 2'). The Seventeenth (two octaves and a major third above its fundamental) is marked by ambiguous labeling; it may be called a Tierce or Terz (Third), or even a Decima (Tenth, also used for Tierce). When added to its fundamental, it adds a pointed if not overbearing sixth partial, and has a give-and-take relationship with the Twelfth (third partial) an octave below.

See also **Stop**

SFORZANDO

A built-in reversible that usually opens the plenum (or something close to it) when engaged, thereby replicating the sudden dynamic marking found in other instruments' music. This combination action is also known as the organ tutti. The sforzando may take the form of a thumb piston or toe stud; many organs have both. In rare cases a separate pedal or an extreme position on a crescendo pedal produces the effect.

See also **Mechanical Aids**

SHALLOT

A brass tube hidden in the BOOT of a REED pipe, with a flattened closed side and an aperture against which a metal tongue vibrates rapidly when wind enters the pipe's TOE (or bore), producing a pitch. The shallot is attached at its top to a block, from which the reed's RESONATOR rises; a hole in the top of the shallot opens into the resonator and allows the tuned vibrating air to continue to the pipe's top. There, the sound begun at the shallot and determined by the resonator is projected fully into the listening space. A small wooden wedge holds the shallot securely in place at the bottom of the block, allowing for uninhibited but controlled tongue vibration. A small piece of metal (tuning wire), operated from above the block, allows the length of the tongue to be changed, thus changing its pitch; VOICING techniques at the top of the resonator may be applied for tuning if necessary.

The shallot is part of the so-called beating reed pipe, dating from at least the fifteenth century. Its mechanism differs from that of the FREE REED, which beats without striking to produce its sound; the latter is the basis of instruments in the reed organ family, including the harmonium, American organ, melodeon, *orgue expressif*, accordion, and concertina.

RICHARD KASSEL

SHARP, RONALD W(ILLIAM) (B. 1929)

Australian organbuilder. Born in Sydney on 8 August 1929, Sharp built his first organ in 1960 for the chancel of St. Mary's Cathedral, Sydney, using electric action; he had never had formal training. Shortly afterward, he adopted mechanical action, culminating in his first major work in this style for Knox Grammar School, Sydney (1965). Sharp later built organs for the Wollongong, New South Wales, Town Hall; the Perth Concert Hall; Ormond College at the University of Melbourne, and Canberra, St. John's Church. He is best known for the monumental instrument in the Sydney Opera House Concert Hall (1969–79; 5/126), the largest mechanical-action organ in the world and the focus of international attention.

Sharp was the first indigenous Australian builder to revive the construction of tracker action instruments. Sharp's approach to organbuilding has been based upon an entirely intuitive approach, an original synthesis of style and sound based upon visits and listenings to many of the leading organs in Europe. His instruments are characterized by a uniquely vibrant and warm sound; they have been widely acclaimed and frequently recorded.

JOHN MAIDMENT

SHIFTING MOVEMENT

See MACHINE STOP

SHORT OCTAVE

See KEYBOARD

SHOVE

The most prevalent type of hand-operated manual COUPLER, used between the fifteenth and early nineteenth centuries, before pneumatics and electro-pneumatics were introduced to organ building; also called push coupler. This mechanical coupler attained its goal—allowing one set of keys to sound two manuals' pipes simultaneously—in two ways. In the shove or push KEYBOARD, a manual (originally the lowest, or closest to the performer) is pushed in (or on occasion pulled out); the backs of its keys engage the backs of the next higher manual's keys, using small, bent "doglegs" or other devices so that the back ends of both move up whenever the lower key is depressed. This increased the amount of weight necessary to produce sound, a problem that decreased as ACTIONS became more sophisticated. The "sliding" keyboard reversed the procedure for coupling; the higher manual is pushed in, engaging the backs of the lower manual's keys directly. The latterly developed octave coupler (1800) used a complicated system of diagonal backfalls to pull down pitches an octave higher; it made KEY action even heavier, a drawback that limited its use.

As instruments grew in size during the Baroque. the shove coupler could be found side by side with a "communication" system, which permitted two pallets (one per keyboard) to operate in the groove of a single chest. The shove mechanism itself was gradually replaced by lever or pedal mechanisms that engaged two keyboards, with or without the need to engage a second manual physically. Pneumatic, electric, and electronic devices eliminated the need for the mechanical coupler and encouraged experiments with multiple couplings that exploited mutations and unusual mixtures, not always successfully. UNIFICATION also lessened the need for coupling. The twentieth-century organ revival has seen a limited return to the shove coupler's use in reconstructions and smaller instruments, but as a contemporary methodology its practicality has been dimmed by two centuries of technical evolution.

See also **Mechanical aids**

RICHARD KASSEL

SHUDI, BURKAT (1702–1773)

English keyboard builder of Swiss origin. Born in Schwanden, Glarus, Shudi (also known as Burckhardt Tschudi), he emigrated to England in 1718, working as a joiner. He began building harpsichords in Soho, London in 1739, moving to Great Putney Street in 1742. In 1761, John Broadwood began working with Shudi, married his daughter, and became a partner in 1769, the year Shudi patented the "Venetian swell," in which harpsichord volume could be varied by "moving louvers" over the strings. There was no direct relationship to the organ SWELL box of that period; organbuilders were concerned solely with the upper (melodic) range. Shudi retired in 1771 and died in London on 19 August 1773; his son Burkat Shudi (1738–1803) replaced him in the partnership; upon the younger Burkat's death, Broadwood became sole owner; the firm had been concentrating on pianos from 1782. Shudi's Venetian swell was adapted by nineteenth-century English organbuilders who placed the shade over rather than in front of the enclosed Swell division.

RICHARD KASSEL

SIFFLÖTE

A Flute stop of 1' pitch, occasionally 1-1/3' or 2'. Its pipes are usually open cylindrical metal, but may be conical or half-conical. Its scale varies considerably, as does its loudness. It dates from the late sixteenth century, and its name may derive from the Italian word *zuffolo* (shepherd's fife). Synonyms include *Sifflet* and *Sufflet*.

See also **Stop**

EDWARD L. STAUFF

SIGNAL ORGAN

An attribution of purpose to the raucous instrument of the second half of the first millenium and early second millenium CE. Noted for its dynamic power, this bodily driven BELLOWS organ was disdained by the Christian clergy, who found its tone inappropriate for celebration of a Mass, not to mention its pagan ancestry. References to the instrument are relatively few and mostly negative, yet its increasing presence in churches before and after the turning of the second millenium CE has led to speculations about its usage under certain circumstances: to accompany (i.e., double) congregational singing, call people to worship or the celebration of festivities, or denote transitional moments in the service or signal its end. The organ seems to have been integrated fully into worship by the twelfth century, particularly as its sound became more palatable.

It may be more cogent to describe the "signal organ" as a transitional phase between the latter-day versions of the HYDRAULUS to the medieval BLOCKWERK instrument.

RICHARD KASSEL

SILBERMANN

German organ-building family. The Silbermanns were well-known builders in their day; they have become legendary since the nineteenth-century Bach revival and the onset of the Organ Reform Movement; this status may be attributed in part to the survival of a relatively large number of their instruments. The master carpenter Michael Silbermann (b. 1650) had two sons who became important builders: Andreas (André) Silbermann (b. Kleinbobritzsch, Saxony, 16 May 1678; d. Strasbourg, 16 Mar 1734) and Gottfried Silbermann (b. Kleinbobritzsch, Saxony, 14 Jan 1683; d. Dresden, 4 August 1753). Andreas's older son Johann Andreas (Jean-André) Silbermann (b. Strasbourg, 24 May 1712; d. there, 11 Feb 1783) continued his father's workshop and brought the Alsatian building style to a wider area.

Andreas Silbermann

Andreas worked with Eugenio CASPARINI (an Italian-trained Silesian) on the latter's "Sonnenorgel" in Görlitz; he moved to Strasbourg, France, then worked with his contemporary François THIERRY in Paris (1704–06). Andreas resettled in Strasbourg to set up his workshop, where he built thirty-five organs reflecting a cosmopolitan mixture of influences; the dominant model was the mid-Baroque French classic style of Thierry. He maintained a lifelong correspondence with Gottfried, who returned to Saxony after completing his training with Andreas in Strasbourg (1702–08), per the agreement they had made when Gottfried began his apprenticeship with his older brother.

One of Andreas Silbermann's first post-Parisian instruments, at Marmoutier, St.-Étienne (1709–10; 2/20), underwent several rebuilds by Johann Andreas. It was restored by Alfred KERN and Ernest Muhleisen (1955; now 3/28). Other organs by Andreas include: Strasbourg, Notre-Dame Cathedral (reb. 1491 Krebs/1511 Süss/1658–60 Tretzscher organ, 1713–16; 3/39; case incorp. Kern, 1981; now 4/47); Strasbourg, St.-Étienne (1716; 2/14; to Bischheim, Protestant Church (1793; rest. G. Kern, 1983; now 2/16); Basel (Switzerland), St. Leonhard (1718–19; extant); Obernai, St. Léonard (1721; 1/7; to Ottrott, SS Simon and Jude, 1793; rest. J.-G. Koenig, 1968; now 2/19); Colmar, Dominican monastery (1726; 3/25; to Niedermorschwihr, St. Gall, 1803; rest. Muhleisen, 1961; now 3/27); Altorf, St Cyriaque (1729–30, with Johann Andreas Silbermann; 2/14; reb. Stiehr-Mockers, 1849–50; rest. Dott, 1999; now 2/22); Ebersmunster, St. Maurice (1730–32; 3/29; his largest new organ; rest. Kern, Koenig, Dott, 1998); Colmar, St. Matthieu (1732; 3/24; reb. Stiehr, 1861; rest. Dott, 1995–98, to 1861 state; now 3/38); and Rosheim, SS Peter and Paul (1733; to Waldolwisheim, St.-Pancrace and reb. Stiehr-Mockers, 1863; rest. Kern, 2000; now 2/23). Of the surviving instruments, those at Ebersmunster and Marmoutier are generally considered the most authentically preserved.

Gottfried Silbermann

Gottfried grew up in nearby Frauenstein, a small town south of Dresden close to the present Czech border; little is known of his early life. He identified Andreas Silbermann as the one from whom he learned the craft of organ building, but Gottfried had to journey to Strasbourg in 1702 for this apprenticeship, joining his brother for several years. Andreas spent two years (1704–06) in Paris at the Thierry workshop, but it is not known whether Gottfried was with his brother during this period or whether he was performing unrecorded minor work back in Alsace. Together they built an organ for Strasbourg, St. Nicolas (1707; not extant).

In 1708 Gottfried left Strasbourg, fulfilling an agreement with Andreas not to work in the same region; by the spring of 1710 he had returned to Freiberg, Saxony, where he set up a workshop. Gottfried became a very successful organbuilder, whether measured by artistic accomplishments or in profits; by his later years he was sufficiently wealthy not to have to build organs to make a living. Like his great contemporary Johann Sebastian Bach, Silbermann stayed close to home; he declined invitations to build instruments in Copenhagen, Moscow, and St. Petersburg. Silbermann, who never married, died in Dresden on 4 August 1753. His most important student was Zacharias HILDEBRANDT.

Research has identified forty-six organs built by Gottfried Silbermann in central Germany: forty-one in Saxony, and five others just over the border in Thuringia and Brandenburg. Gottfried apparently counted four instruments built with Andreas in Strasbourg as part of his oeuvre, making for a total of fifty organs. Four organs had three manuals; twenty-two had two manuals; eleven had one manual (with pedal); and a number of positives. The specifications of the others are unknown. Among the thirty-one surviving instruments (original or restored) are Freiberg, Cathedral (1714; 3/44; rest. Jehmlich, 1981–83); Grosskmehlen, Dorfkirche (1718; 2/22; rest. Rühle, 1995–96); Rötha, St. Marienkirche (ca. 1722; 1/11; rest. Eule, 1935); Crostau (1732; 2/20; rest. 1980–82); Ponitz, Dorfkirche (1737; 2/27; rest.

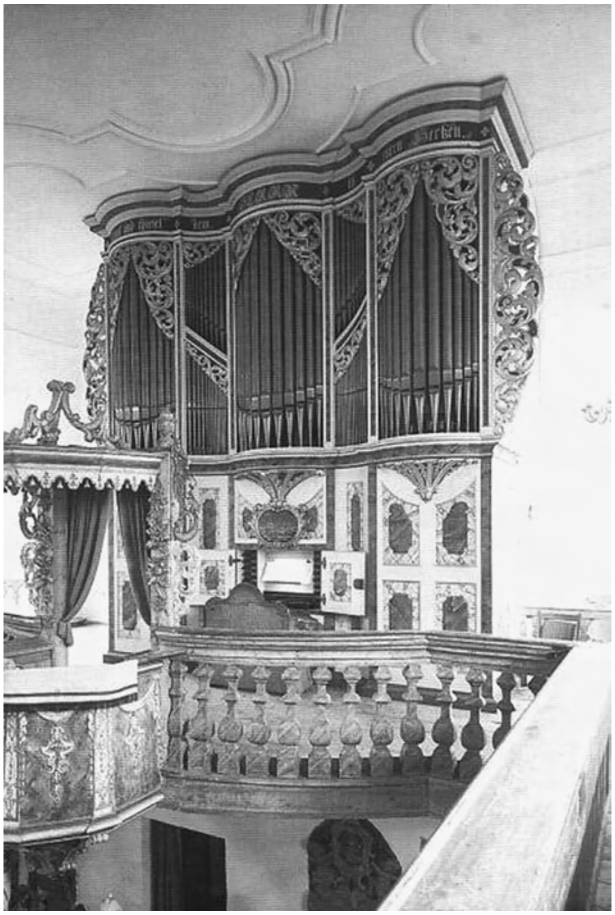

Fig. 71. Gottfried Silbermann organ, 1734–37 (2/27; rest. Eule, 1983–85), Friedenskirche, Ponitz, Germany.

Eule, 1984); Schleiz, Burgk Castle, reb. 1639 Caspar Kerll organ (1743; 1/12; rest. Eule, 1982); and his largest instrument, Dresden, Cathedral (former Hofkirche), completed by his assistants (1755; 3/47; dism. 1944; reconstr. Jehmlich, 2001–2). Among the important instruments now lost are Dresden, Sophienkirche (1722; destr. 1945), Dresden, Frauenkirche (1736; destr. 1945), Greiz (1739; destr. 1802) and Zittau (1741; destr. 1757). Organ projects never realized by Silbermann include a large two-manual instrument for Zwickau (sought by the organist there, Johann Ludwig Krebs, a Bach student), an organ for Prague, and a large three-manual instrument, comparable to the Freiberg Cathedral organ, for the Leipzig Paulinerkirche (1710). Dispositions of Silbermann instruments follow.

Dresden Hofkirche (1755)
This three-manual may be taken as representative of the four Silbermann instruments of this size:

Hauptwerk (HW, Manual II)

Principal	16
Bordun	16
Principal	8
Viol di Gamba	8
Rohrflöt	8
Octava	4
Spitzflöt	4
Quinta	3
Octava	2
Tertia	1-3/5
Cornet	V
Mixtur	IV
Zimbeln	III
Fagott	16
Trompet	8

Oberwerk (OW, Manual III)

Quintadehn	16
Principal	8
Gedackt	8
Quintadehn	8
Unda Maris	8
Octava	4
Rohrflöt	4
Nassat	3
Octava	2
Tertia	1-3/5
Flaschflöt	1
Echo Cornet	V
Mixtur	IV
Vox Humana	8

Brustwerk (BW, Manual I)

Gedackt	8
Principal	4
Rohrflöt	4
Nassat	3
Octava	2
Quinta	1-1/2
Sufflöt	1
Sesquialtera	4/5 (1-3/5 from c^1)
Mixtur	III
Chalumeaux	8

Pedal

Untersatz	32
Principalbass	16
Octavbass	8
Octavbass	4
Ped. Mixtur	VI
Posaunbass	16
Trompetbass	8
Clarinbass	4

Tremulant (II)
Schwebung (Tremulant III)
Shove couplers: I/II, III/II
Bassventil (II/P ventil coupler)

Reinhardtsgrimma (1731)

Silbermann’s twenty-two two-manual organs are most easily classified in three groups: (1) four instruments with a 4' Principal–based Oberwerk, all built during Silbermann’s early years (1717–27; e.g., Rötha, Georgenkirche, 1721); 2) the six biggest two-manual organs, with between twenty-seven and thirty-two stops and an Oberwerk based on an 8' Principal (Ponitz, 1737); and (3) the largest group (twelve organs) with an Oberwerk having a lowest Principal stop of 2' pitch. In locations where vertical dimensions were limited, the Oberwerk was converted into a Hinterwerk, as is the case with the Reinhardtsgrimma organ:

Hauptwerk (HW; Manual I)

Principal	8
Rohr-Fleute	8
Quintadena	8
Octava	4
Spitz-Fleute	4
Quinta	3
Octava	2
Cornett	III
Mixtur	IV

Pedal

Sub Bass	16
Octaven Bass	8
Posaunen Bass	16

Hinterwerk (HinW, Manual II)

Gedacktes	8
Rohr-Fleute	4
Nassat	3
Octava	2
Tertia	1-3/5
Quinta	1-1/3
Suffleute	1
Zÿmbeln	II

Tremulant
Shove coupler: II/I
Ventil coupler (permanent): I/P

Single-Manual Organs

Silbermann built two types of one-manual organs with pedal, both based on an 8' Principal. One type had from eleven to thirteen stops (Schleiz, Burgk Castle, 1743). The other had between thirteen and fifteen stops; their specifications are similar to the instrument formerly at Freiberg, Johanniskirche (1719; to Freiberg Cathedral): Manual: Principal 8’, Gedackt 8’, Octava 4’, Rohr-Flöthe 4’, Nasat 3’, Octava 2’, Quinta 1-1/3’, Sufflet 1’, Cornett III, Mixtur III, Cimbel II; Pedal: Sub-Bass 16’, Posaunen-Baß 16’, Trompeten-Baß 8’; Tremulant; Ventil Coupler (permanent). Silbermann’s positive organs varied from 5 to 9 manual stops; the Ringethal instrument (ca. 1725) was typical: Gedackt 8’, Principal 4’, Rohr-Flöthe 4’, Octava 2’, Quinta 1-1/3’, Sifflet 1’.

Silbermann built new organs almost exclusively, did not reuse pipes from previous instruments, and had a limited, closely defined repertoire of stops. The specifications for the Dresden Hofkirche organ include almost all stops Silbermann made; only the 16' Subbass (Pedal), 4' Clarin (HW of two early organs), 8' Krummhorn (OW, Freiberg Cathedral), and 2' Gemshorn (OW, BW) were not used in Dresden. Characteristic for Silbermann was a complete series of unison, octave, and mutation pitches from 8' to 1', very few manual reed stops (except on large instruments), and no 4' pedal stops (except on three-manual organs). Chorus mixtures (Mixtur and Cymbel) contained only octaves and fifths; the Cymbel, with fewer ranks than the Mixtur, merely duplicated the upper pitches of the Mixtur. Silbermann invariably used tin for manual reed stops, conical stops (Viola da Gamba, Spitzflöte, Gemshorn), and the Principal chorus. Common pipe metal was found only for stops requiring a delicate mouth (Bourdon, Gedackt, Rohrflöte, Nasat). Wood was used for the bottom octave of some manual stops and for most pedal stops.

While it is easy to overstate the French influence on Silbermann and in so doing deny the basic Saxon character of his instruments, there was a definite French or Alsatian element, not surprising given his work in Alsace (and possibly Paris). Manifestations include: the use of French nomenclature (Praestant, Doublette, Pleinche [Plein jeu], Bombard); the mounted Cornet (called “a French stop” by Silbermann) on eight organs and the Cornet *décomposé* (8.4.2-2/3.2.1-3/5) found on nearly every Oberwerk (or Hinterwerk) and Brustwerk; the French-style construction of Trompete and Clarin stops (before 1721); a Mixtur-Cymbel relationship akin to the French Fourniture-Cymbale; French construction methods, such as the hammering of pipe metal (singled out in the examination report of the Freiberg Cathedral organ as “unusual” for Saxony); and the “new” sounds (1-3/5' Tierce, Cornet V), two common French stops that Silbermann felt compelled to explain to the authorities for his Leipzig proposal.

Notwithstanding these French qualities, the influence of Silbermann’s native Saxony was even greater on his work. His rejection of the Rückpositiv was one typically central German trait; despite organ plans early in his career that called for a Rückpositiv division, local custom won out; he built only Hauptwerk (HW), Oberwerk (OW), Hinterwerk, and Brustwerk (BW) manual divisions throughout his Saxon career. Silbermann described his manual and pedal divisions as having scalings sounding “large and grave” (HW), “sharp and penetrating” (OW), “delicate and sweet” (BW), and “strong and penetrating” (Pedal), the differentiation also recommended by Andreas Werckmeister (1698). Other indications of his nonallegiance to French style include: stops unknown or rare on classical French instruments (16' and 8' Quintadena, 1' Sifflöte, 8' Unda maris, and the conical 8' Viola da Gamba); the lack of manual reed stops on most Silbermann organs, in contrast to the wealth of reeds found on French instruments; and the absence of short-compass manuals in Saxony to correspond to the French Récit or Echo. Occasionally, supposedly "French" stops turn out to have been prevalent in Saxony. Unlike his contemporaries in central Germany, however, Silbermann did not build overblowing stops, string-toned stops of cylindrical or inverted conical construction, or manual registers made entirely of wooden pipes. The decline of French influence in the construction and disposition of reed stops after 1720 was also apparent in Silbermann's work.

Pedalboard compasses of all Silbermann organs were twenty-four notes (C, D–c'). Manual compasses were normally forty-eight notes (C, D–c'''), occasionally fifty notes (C, D–d'''). Most Silbermann organs were at choir pitch (*Chorton*), the higher tuning normal for church organs (a' = 460 to 465Hz, rarely 470Hz). The organs in Zittau and Dresden were among the six or seven originally in chamber pitch (*Kammerton*; a' = 410 to 414Hz). Silbermann employed one or more unequal temperaments for his organs; but archival documents show that his organs were retuned to equal temperament in the nineteenth century. Although at least two examination reports of important organs found that Silbermann's temperament was "acceptable and suitable for use in all harmonies," the organist and music theorist Georg Andreas Sorge and two Bach students criticized Silbermann's temperament. While some have posited a sort of meantone temperament, recent reconstructions (Gress, 1989) point to an irregular compromise temperament in which all harmonies are available but remote keys sound less pure.

Like some of his organ-building contemporaries, Silbermann was also a builder of stringed keyboard instruments. He built harpsichords in France and his early years in Saxony. It is likely he experimented with such instruments as the cembal d'amour, a type of clavichord with double-length strings, and the early fortepiano. Silbermann also built clavichords (Carl Philipp Emanuel Bach's favorite was a Silbermann), and he refined the fortepiano in the last years of his life. It was a Silbermann pianoforte in Potsdam upon which J. S. Bach played and commented.

Gottfried Silbermann was the greatest German organbuilder of the late Baroque period. More books and articles have been written about Silbermann than any other builder; newspaper notices appeared as early as 1800. A number of legends concerning his youth and apprenticeship were perpetrated in the nineteenth century in books by Josef Krömer (pseudonym: Ludwig Mooser). It is only in the last fifty years that other authors listed in the Bibliography have exposed Krömer's fables for what they are, and have set the standard for Silbermann research by providing a wealth of factual information on the man and his work.

James L. Wallmann

Johann Andreas Silbermann

Johann Andreas worked with his father Andreas from around 1729, and was the natural successor in 1734. He left the firm in the hands of his younger brothers Johann Daniel (1717–66), Johann Gottfried (1722–62), and Johann Heinrich (1727–99) to travel to Freiberg to learn from his uncle Gottfried. This study, combined with his father's teachings, led to Johann Andreas's stylistic synthesis: while Andreas's organ were more French and Gottfried's more German in nature, Johann Andreas created the true Alsatian style that served as the basis for a group of builders of the late eighteenth (François Callinet, Conrad Sauer), nineteenth (Callinet, Martin and Joseph Rinkenbach, Sauer, Stiehr-Mockers, Georges Wegmann, Martin Wetzel) and twentieth centuries, the last in concert with the Alsatian reform movement of Albert Schweitzer and its consequences (Antoine Bois, Richard Dott, Kern, Koenig, Muhleisen, Rémy Mahler, Roethinger, Georges Schwenkedel, Alfred Wild).

Johann Andreas built over sixty instruments, most in Alsace, with others in Switzerland (Arlesheim, Dom, 1761; rest. Metzler, 1959–62; now 3/36), the "Pays de Bade" in Germany (St. Blasien, Benedictine abbey, 1772–75; 3/47; to Karlsruhe, St. Stephan, 1813; destr. 1944), and Lorraine (Saint Quirin, 1744–46; 2/15; rest. Kern, 1969). He was also a member of the Strasbourg town council, author of several writings on Alsatian history, and compiler of information on organs. (Bequeathed to the Strasbourg library, many of his manuscripts were lost in an 1870 fire.) Among his Alsatian instruments are: Strasbourg, St. Thomas (1737–41; 3/31; reb. M. Wetzel, 1836, 1860; saved by Schweitzer, 1908; reb. Schwenkedel. 1927, 1938; reconstr. Kern, 1979; now 3/39); Soultz, St.-Maurice (1750; three manuals; enl. Callinet, 1819; Récit added; rest. Schwenkedel, 1960–70; 3/31; first modern French organ in meantone temperament); Colmar, St.-Martin (1755; dism. 1911; reconstr. Felsberg, 1979; 3/48; after Schnitger!); Strasbourg, St.-Aurélie Protestant, compl. 1718 A. Silbermann (1765; 2/17; reb. Dalstein-Haerpfer, 1911; 2/33, Récit replaces Positif; used in Schweitzer recordings; reb. Muhleisen, 1952; neoclassical, now 3/52); Mulhouse, Old St.-Étienne (1766;

3/31; dism. 1858; to Mulhouse, St. John Reformed, 1868; case incorp. Walcker, 1877, 1910; 2/29, pneum.; reconstr. Kern, 1972; 1766 state, mech.); Guebwiller, Dominican church (1771; to Walbach, St. Jacques, 1792; 1/13; case incorp. Rinkenbach, 1900; reb. Schwenkedel, 1954; 2/14; reconstr. Bois, 1989, 2002; now 2/20); Strasbourg, St.-Pierre-le-jeune (1779–80; 1/16; enl. Sauer, 1820; 2/22; enl. Muhleisen and Kern, 1948–50; neoclassical, now 3/41); Gries, Protestant Church (1781; 1/13; rest. Kern, 1979); Molsheim, Trinité St.-Georges (1783; 2/22, divided Echo manual; reb. Kriess, 1887; Récit replaces Echo; reconstr. Kern, 1969–71; 1783 state).

Johann Andreas's best-known apprentice, Johann Andreas Stein (1748–49), became a fortepiano builder whose instruments were admired by Wolfgand Amadeus Mozart. His brother Johann Heinrich Silbermann became a clavichord builder. His other two brothers, who worked in the Silbermann workshop, died long before Johann Andreas; it is noteworthy, however, that in Gottfried's last will, he refers to Johann Daniel (also an organist in Strasbourg) as his "only true heir." Two of Johann Andreas's sons worked in his shop, but neither Johann Daniel (1746–1770) or Johann Josias (1765–1786, his "successor" for only three years) were able to carry on the legacy.

Conrad Sauer, Johann Josias's foreman, married Johann Andreas's daughter Frédérique and took over the workshop in the traditional manner. Their son, Johann Conrad Sauer (1775–1828), continued his father's business. His son, Johann Paul Silbermann, did not go into the organ-building trade; however, his sister Catherine married the builder Martin Wetzel (1794–1887), who thereafter claimed title to the Silbermann legacy. Johann Andreas's surviving papers stayed with Johann Paul's family, the basis of the Johann Andreas Silbermann Archive in Paris.

RICHARD KASSEL

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SILESIA

A region, once part of Germany, now in Poland (except Lusatia, in Saxony). Silesia (Schlesien) has never been a truly independent political identity; at different times, areas have belonged to the old Polish kingdom, Bohemia, Holy Roman Empire, Austrian and Austro-Hungarian empires (notably Teschen, now in the Czech Republic), Prussia (when Silesia was first divided into lower and upper regions), post–World War I Germany and Poland, Nazi Germany (when the two regions were reunited), and Poland once again. Historically, the region has been a major battleground because of its geographical location between Germanic and Slavic peoples, its considerable coal deposits, and the struggle between Catholicism and Protestantism (as early as the Hussites in the fifteenth century). The greatest destruction occurred toward the end of World War II, when advancing Russian and retreating German troops adopted “scorched earth” policies. Churches and their organs were not spared; before World War II, Silesia had more instruments than any other eastern German province (over 2,100); by war’s end and the period of German depopulation (after Silesia was restored to Poland), less than half of the instruments remained, and many of these in poor or unplayable condition. Economics and state policy limited rebuilding under communism; even with the return of the capitalist republic, the full restoration of religious freedom has not led to the rapid restoration of organs damaged in the war.

Given (and despite) all these factors, Silesia has been a home for organ building since at least the fourteenth century, with mention of instruments in Sagan (now Zagan, Poland) and Görlitz/Zgorzelec (city divided in 1945); the death of the builder Magister Orthulphus is recorded in 1383. In the next century, the most active area was the capital, Breslau (Wroclaw), featuring work by native son Stephan KASCHENDORF at St. Maria-Magdalenakirche (1455) and St. Elisabethkirche (1460–63); another instrument was installed at St. Maria auf dem Sande, (1447); the cathedral instrument was renovated (1430). The Niederkirche in Liegnitz (Legnica) had an organ by 1438; Augustinian abbeys received new instruments in Glatz (Klodzko, 1464) and Sagan (1496) in the 1490s. Schweidnitz (Swidnica) and Brieg (Brzeg) each had an instrument by the end of the century.

The sixteenth century continued the relatively inactive pace of organ building. In Neisse (Nysa), a chronicle reported an instrument lost in a fire at the Jakobskirche (1542); a full-size organ was installed by Simon Faber (1548), and a smaller one moved in from another church (1556). Even a small town like Langhelwigsdorf (now part of Jawor) installed a new organ (1517). But knowledge of sixteenth-century Silesian instruments derives primarily from a visit from a papal legate (1580). There was an organ in the Glogau (Glogow) cathedral, and two in its “satellite” Annenkapella; yet in the other Catholic areas, there were only a total of three (Gross-Glogau, Beuthen am Oder [Bytom Odrzanski], Brunzelwaldau[Broniszów]). Two builders known to have worked in the area were Michael Hirschfeldt of Sorau (Zary, fl. 1592–60, d. 1602), whose experimental collaboration with architects building Breslau’s new Maria-Magdalenenkirche (1592–1600) resulted in an organ so unsuccessful that it was dismantled shortly after Hirschfeldt’s death; and Matthias Nebel of Breslau (fl. 1592–1603), who built instruments for his home city and Görlitz.

The seventeenth century saw an increase in organ building in Silesia, despite and because of the Thirty Years’ War (1618–48). The increasing German presence meant new Evangelical-Lutheran churches, not to mention the activities of the Counter-Reformation and already established places of worship. By 1652, Upper Silesia had instruments in Ratibor (Racibórz), Sohrau (Zory), and Loslau (Wodzislaw Slaski). Two more papal legate visits (1679, 1687) revealed new organs at Tost (Toszek), Gleiwitz (Gliwice), Cosel (Kedzierzyn-Kozle), Freystadt (Kozuchow), Grünberg (Zielona Góra), Sprottau (Szprotawa), Ujest (Ujazd), and Leschnitz (Lesnica). More importantly, individual builders began to assert their presence by working in Silesia or building for Silesian churches and cities: the CASPARINI family, members of whom worked in various

Silesian cities; the Decker family of Görlitz; Wilhelm Haupt (1578–1658), active in Breslau from 1627; Franz Anton Kretschmer of Schweinitz (fl. 1611–1624); Zacharias Friedel of Bunzlau (Boleslawiec, fl. 1603–1619), whose "great reputation" has disappeared with his instruments; the Klose family of Brieg; the Rischak family of Troppau (Opava, Czech Republic), active into the next century; and Johann Caspar Waldhauser of Neumarkt (Sroda Slaska, fl. 1688–1710).

The eighteenth century saw the peak of local Silesian organ building, despite the numerous wars among surrounding powers and the political instability that resulted. The best organs of the era were fine examples of the high Baroque, noted for excellent reeds and clarity of tone. The important families in the region included the ENGLER family of Breslau, one of the most important Silesian builders and among the most prolific; the Meinert family of Lähn (Wlen), especially active in the Grünberg, Hirschberg (Jelenia Góra), Freystadt, Jauer (Jawor), and Schweidnitz districts; the Eberhardt family, Catholics who built primarily for that denomination's churches (some with clock mechanisms) in Sprottau, Neisse, Wartha (Bardo Slaskie), Breslau, Görlitz, Bunzlau (Boleslawiec), Striegau (Strzegom), Liegnitz, and Oels (Olesnica); Berlin native Johann Michael Martin Röder (fl. 1706–1745), a Schnitger apprentice and a major builder in the North German style, who later relocated to Silesia; Ignatius Mentzel of Breslau (fl. 1693–1729), many of whose instruments were destroyed in World War II; the Scheffler family of Brieg, who were sufficiently appreciated by their contemporaries so that, when their home was burned down (1776), they received a royal gift to help rebuilt the premises; and Peter Zeitzius of Frankenstein (Zabkowice Slaskie, 1730–1797), noted for his productivity (more than forty new instruments in thirty-four years).

As organs grew more "romantic," Silesian builders followed trends from the north and west, although the relative size of the churches meant more two- and one-manual instruments than the grand three (and more) manuals of the Rhine region and Berlin. Plenty of local builders were prepared to fulfill the needs, now spurred on by economic and political stability rather than religious competition. Johann Christian Müller, Franz RIEGER, Christian Gottlieb SCHLAG, and Karl Wilhelm ran the most active workshops in the nineteenth century. Müller apprenticed and worked with the Englers, then set out on his own around 1800; the last builder in the family died sometime after 1892. Rieger founded his firm in Jägerdorf (formerly Austrian Silesia, now Krnov, Czech Republic) in 1845. The company continued in the family under different names until 1920, when Josef Glatter-Götz took over. Schlag bought out the Kiesewetter firm in Jauer (1831) and moved it to Schweidnitz; the firm continued in the family under different names until its demise, ca. 1918. Schlag was one of the most progressive of Silesian builders, open to influences from outside the region. Karl Wilhelm (1847–1889) founded a firm in Breslau (1871); the company continued operations until 1916, when Willy G. Huth took over.

Among smaller local builders were Gottlieb Anders (Oels, 1833–1894); the Walt[h]er brothers of Guhrau (Góra Slaska), active 1850–1914; the Buckow and Schinke families (both Hirschberg); the Silesian born Ludwig Hartig (fl. 1825–1850); Edmund Horn (1830–1895) and Eduard Theinert (1830–1895), both of Breslau; Georg Friedrich Müssig (1794–after 1841), active in Freiburg (Swiebodzice) and Jauer, equally known for automatic keyboards; and, tragically, Reinhold Hundek (1855–1888), who worked in Ober Glogau (Glogowek) and Neisse, went bankrupt, and committed suicide.

Nineteenth-century Silesia was subject to the same influx of outside builders that other German regions were, especially after unification (1871). The most active before World War I were Friedrich LADEGAST, Wilhelm SAUER, and, to a lesser extent, E. F. WALCKER. The location of Sauer's firm (founded 1857 in Frankfurt am Oder) was no doubt an advantage in securing Silesian business. On the other hand, Silesian builders were increasingly active outside their own region, including the Rieger firm (Debowiec, Jasienica, Leszna Gorna, Nasielsk, Ustron, Warsaw, Zyrardow), the Müller family (Powazki Cemetery, Warsaw, Wegrowo), Gottfried Riemer (Cieladz, Pilica, Warsaw); Schlag und Söhne (Warsaw, Wyszogrod), the Scheffler family (Lowicz), the Walt[h]er brothers (Gostyn), and Karl Kuttler of Troppau (Biala), Martin Luther Church).

The damage to Silesia's churches during World War I was somewhat reduced by the withdrawal of Russia from the war in 1917. Despite the German defeat, most of the new Polish republic was carved out of the Austro-Hungarian Empire, and most of Silesia remained German. In the interwar period, the coal and old industrial regions of Upper Silesia were especially active in the building of new churches and organs, especially after relative economic stability arrived in 1923. The Rieger firm expanded its operations into Poland. Another firm, the Reichthal-based Spiegel family, moved its operations to Oppeln (Opole) in 1905, and built small instruments. On the other hand, the Polish firm Klimosz-Dyrszlag of Rybnik opened an affiliate in Gleiwitz. Smaller firms also flourished. D. Biernacki of Leslau (Wlocklawek, now in Russia) opened an affiliate in Kattowitz (Katowice, 1934); other outside firms active in Silesia included Wl. Kaczmarek, Krukowski und Sohn, Piotrkow

Trybunalski (instruments in Golleschau [Goleszów] and Kattowitz), and Wronki (in Chorzow). Familiar major builders of a progressive ilk (Sauer, Walcker) continued and increased their activities in Silesia, turning much of their attentions to restoration, an increasingly significant and respected segment of the field. Another major firm, that of Paul Berschdorf and his son Carl, was located in Neisse and in business from 1889 to 1945. A more conservative builder of romantic tastes, later Berschdorf organs showed some signs of neobaroque tendencies. All told, the firm built over 150 instruments, including those at Beuthen a. Oder, St. Barbarakirche; Gleiwitz, St. Bartholomäuskirche; and several organs in its home city, six of which survive (notably, in the St. Elisabethkirche).

World War II stopped organ building throughout Germany by 1940. As previously mentioned, the toll of the war on Silesia was stunning in its destructiveness. Further, unlike other German regions that ended up in East German hands, the Silesians found themselves once more under Polish rule. The departure of most Germans in the years after the war may have appeased the Polish population, but the economic situation was made even more desperate. Among the immediate casualties was organ rebuilding, further discouraged by the Soviet-dominated communist government in the revived Polish republic. Poland would reassert its traditional Catholicism as soon as economic conditions had improved sufficiently; but the church buildings were the first priority, and organ restoration was hampered by the near disappearance of the industry there. Gradually, nationalized East German firms such as Sauer were able to do some of the work. The end of Polish communism lifted remaining ideological barriers, but German reunification shifted that country's efforts back to itself, especially with the advantages of the strong West German economy. Slowly, Polish Silesia continues to rebuild its organs, despite all difficulties.

Richard Kassel

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SIMMONS, WILLIAM B(ENJAMIN) D(EARBORN) (1823–1876)

American organbuilder. Born in Cambridge, Massachusetts, 27 April 1823, Simmons began his career at age fifteen as an apprentice to Hook and Hook, later working for Thomas Appleton. An additional duty at Appleton's was to demonstrate finished organs standing in the factory. In 1846 Simmons and Thomas McIntyre, apparently a pipemaker, left Appleton to open a workshop under the name Simmons and McIntyre. During the partnership's five years they built more than forty organs (at least four of which had three manuals) for churches in a wide geographical range—from Georgia to New Brunswick on the East Coast, as far west as Missouri, and in every northeastern state. They boasted that their organ for Roxbury, First Church (1850) was the largest in New England.

In 1851 McIntyre left the partnership; the following year, Simmons built a sizable three-manual instrument for Boston, Williams Hall. By this time he was advertising that he had the largest organ-building factory in Boston. During the ensuing decade Simmons continued to build organs, many for large and prestigious churches, including Montpelier, Vermont, First Congregational (1855; 2/33), which featured numerous divided stops and a small Pedal division. One of the few instruments that remain from this period, in East Boston, Massachusetts, Most Holy Redeemer Catholic (1855–56), is evidence of the high opinion in which Simmons's work was held.

George Fisher, apparently a cabinetmaker, was briefly Simmons's partner (1856–57; Philadelphia, St. Jude's Episcopcal); between 1858 and 1860 he was in partnership with John H. Willcox (1827–1875), a charismatic organist who shared Simmons's progressive ideas on organ building. (Willcox later worked with George S. Hutchings.) They built large organs for places such as Cambridge, Massachusetts, Harvard University, Appleton Chapel (1859; 3/49); Albany, New York, St. Joseph's (1959; 3/50; large Pedal division); and Louisville, Kentucky, St. Paul's Cathedral (1860). During the 1860s Simmons built organs of all sizes for places as remote as Hawaii, but his last large organ was completed in 1872 for Philadelphia, Second Presbyterian. At this point the volume of his work declined sharply, probably due to ill health, and he moved his operations to a smaller shop. He died in Boston on 31 October 1876.

In a time when many new tonal and mechanical developments were affecting organ design, Simmons was a pioneer. He was among the first U.S. builders to extend the old "English" GG compass (modern G) to the "German" CC compass (modern C; 61 keys), and the first to adopt the Barker lever in larger organs. He is also credited with the first or early American use of German cone-chests, detached consoles, terraced stop-jambs, parallel double-rise bellows, and adjustable combination actions. Having employed short Swell divisions, he expanded their range to full compass.

BARBARA OWEN

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SIPE, ROBERT L. (B. 1940)

American organbuilder. Born in Dallas on 4 September 1940, Sipe's organ-building experience began in high school and continued as a student at Baylor University in Waco, Texas. He gained additional experience through the study of organs in Europe. After completing the sacred music program at Baylor, he entered into partnership with J. Rodney Yarbrough (1960–64). In 1965, Sipe continued independently as Robert L. Sipe, Inc., until he joined the ÆOLIAN-SKINNER ORGAN COMPANY in 1968 as their Texas representative. In 1969, he became the vice president and co-owner and expanded its production to include mechanical action organs. He then also served as technical and artistic director (1970–72). Perhaps sensing Æolian-Skinner's impending collapse, Sipe returned to Dallas to continue organ building under his own name.

Sipe's instruments reflect the ORGAN REFORM MOVEMENT that followed upon Albert SCHWEITZER's 1905–06 articles advocating a return to seventeenth- and eighteenth-century organ design. Among the guiding principles are low wind pressure, slider windchests, mechanical key action, the integrity of each division housed in the main case, and a free-standing case to encourage projection of the sound. His organs also allow for modifications which facilitate the performance of nineteenth and twentieth-century organ music.

Sipe's first eight instruments (1961–70) were constructed under the name Sipe-Yarbrough (Little Rock, Arkansas Westover Hills Presbyterian, 1967; 2/18; reb. Parkey, 2002; now 2/24). From 1971 to 1973, his instruments were built under the Æolian-Skinner name (Dallas, Church of the Transfiguration, 1970–71; 2/13; mech.). These instruments use tracker action and range from seven to thirty-nine stops. Some forty instruments have followed, located throughout the United States. Although many of these instruments are mechanical action, most of the organs built between 1993 and the present use electric action at least in part. Sipe's instruments range in size from a four-stop residence organ to his largest instrument, at Minneapolis, Hennepin Avenue United Methodist (1980; 3/55). Among his other instruments are: Salt Lake City, Temple Square Assembly Hall (1983; 3/49, mech./electric); Duluth, Minnesota, Cathedral Church of Our Lady of the Rosary (1988; 2/25, mech./electric); and Phoenix, Arizona, First United Methodist (1995; 3/46; electric).

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SITARSKI, JÓZEF (FL. CA. 1740–1768)

Polish organbuilder. Sitarski was among the most original builders in Europe during the mid-eighteenth century, judging by the well-known Jedrzejów organ (1745–51; 3/37). (For an illustration of this instrument, see POLAND.) He incorporated some unusual stops, such as the Polish Cymbal. He built several large instruments, including Cracow, Dominican Church (1765–68; 2/24). He paid a great deal of attention to the elegant finish of his organ cases and consoles.

See also **Poland**

JERZY GOLOS

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SIXTEEN FOOT

The register an octave below the unison EIGHT FOOT register; in modern terms, the octave beginning at C = 64Hz. Sixteen-foot stops are documented to the fourteenth century, first as part of the BLOCKWERK (Halberstadt, 1361, with a pull-down pedalboard), later in the emerging HAUPTWERK (fifteenth century) and other manual divisions, and finally as part of a separate PEDAL division.

The 16' Principal became the central building block of the Hauptwerk, analogous to the Montre, Diapason, and (in a few instances) the ripieno Principale. Other 16' stops such as Praestants ("case pipes"), Quintadenas, Flutes, Trumpets, and Bourdons became part of the Hauptwerk; once the Pedal had achieved independence, the 16' (as well as the 32') became the lowest registers of a division that nonetheless could provide a solo voice (e.g., the Trombone for chorale melodies) in addition to participation in a harmonic/contrapuntal texture. A 16' stop was used in a RÜCKPOSITIV at the turn of the seventeenth century (Groningen; cited by Praetorius, 1619), but was more prominent in Baroque OBERWERK, UNTERWERK, BRUSTWERK, and SWELL divisions. By the nineteenth century, instruments included at least one 16' stop in all divisions (except the Récit). In the ORGAN REFORM MOVEMENT and post–World War II authenticity concerns, the 16' register regained its place as the lowest register, based on the aesthetics of the great Baroque German builders and others.

Sixteen and 32' pipes are difficult to fit into smaller spaces (some churches, homes), especially when maintaining acoustic balance is a primary consideration. To this end, builders have used the STOPPED PIPE for centuries, the doubled air column producing the desired register; in the nineteenth century, the HASKELL BASS provided an alternative by placing cylindrical objects in the top of the resonator. While these "artificial basses" lack the power of their full-length equivalents, they can in most cases fulfill the role that the latter cannot under the circumstances.

See also **Eight Foot; Stop**

RICHARD KASSEL

SKINNER, ERNEST M(ARTIN) (1866–1960)

American organbuilder. Born in Clarion, Pennsylvania, Skinner worked with George H. Ryder and Jesse Woodbury in the 1880s; his most significant position was with George S. HUTCHINGS (1889–1901), for whom Skinner developed that company's first electro-pneumatic action in 1893. Skinner left Hutchings to establish his own business. Early partners included James Cole (Skinner-Cole Company, 1902–04) and Robert HOPE-JONES, the company's vice president (1905–1907); Skinner then became sole proprietor of the Ernest M. Skinner Company. Skinner's mechanisms were sturdily constructed, designed for efficient operation and ease of maintenance and repair. While many of his designs were rooted in older practices, he refined them into a standard of reliability superior to the mechanically transitional period of the late nineteenth century.

Skinner's PITMAN CHEST, a means of controlling individual notes from different stops, uses a small metal piston (the pitman itself) that, when activated by an imbalance in WIND PRESSURE, generates another pressure imbalance that in turn pressures wind into the pipe to be sounded. His perfected pitman chest of 1909 was the mechanical foundation of his significant instruments. This new chest strongly resembled its predecessor, which Skinner had developed for Hutchings: a two-stage primary ACTION exhausted air through channels in the chest table; the pitman stop control was attached to the bottom of the pouchboard and exhausted through a stop-action primary. In the older style of chest, the note pouches were mounted vertically on the separators in the chest, channeling the wind up to the table and topboard. In the 1909 modification, the pouches were mounted on a board screwed under the chest table; the pitman stop action was then attached beneath the pouchboard. A small but critical improvement, this new arrangement permitted excellent access and ease of maintenance and restoration.

Skinner's early tonal schemes were based upon late-nineteenth-century ideas. He employed a range of 8' flues at varying dynamics, building choruses with a moderate amount of upper work. The Chorus reeds were Trumpets patterned after the work of England's Henry WILLIS, whose organs Skinner studied during a journey in 1898. The solo reeds represented Skinner's first attempts at imitating orchestral instruments. The overall result was an updated expression of the Hutchings ideal of 1895–1902. The first distinctly twentieth-century Skinner was built for New York, Cathedral of St. John the Divine (1910; 4/88); it included symphonic STOPS such as Orchestral Oboe, Flugel Horn, English Horn, Saxophone, Clarinet, a large-scale flared Gamba Celeste, and a commanding Tuba Mirabilis on 25" wind, extended to 32' in the Pedal. The prominent foundation, restrained upper work, and fairly brilliant reeds produced a new definition of ensemble. Other tonal schemes from this period (1909–18) introduced other orchestral colors: Celesta (1909), English Horn (1909), Corno di Bassetto (1912), French Horn (1912, patent), Bassoon (1915), Musette (1918), and an ongoing refinement of string tone (Gambas, Salicionals, and Dulcets). Chorus reeds became larger in scale and darker in tone, resembling modified Tubas of varying strengths. In moderately sized four-manual organs, the Choir and Solo divisions would share an enclosure as well as some duplexed stops, but this practice was discontinued after 1919. During this period, Skinner developed and patented a PLAYER PIPE ORGAN, the Orchestrator, which played six independent voices (other systems controlled three or fewer). This system proved too complex for production, however, and was redesigned into a reliable three-voice unit.

Skinner's second significant period (1918–24) began with his definitive concert organ for Carnegie Hall, Pittsburgh (1918; 4/108). The Carnegie Hall organ contained Skinner's first STRING division (six ranks under separate expression) and a piano-playing mechanism connected to an on-stage Steinway (a variation of the centuries-old CLAVIORGAN concept). The early 1920s saw more enormous contracts. The largest was for the Cleveland Public Auditorium (1921; 4/145), an instrument with complete flue and reed choruses on all manuals, plus Skinner's new Heckelphone, Musette, and Gross Gedeckt. This instrument fully codified Skinner's early ideal of a symphonic organ into a distinct style. Unlike other builders of the time, Skinner staunchly rejected enclosed GREAT divisions and manual UNIFICATION, insisting on complete flue choruses on larger instruments. The principal feature of his instruments, however, was the abundance of color and FOUNDATION STOPS.

Skinner was an artist first and a businessman never; his company's finances were always precarious. In 1919 he sold controlling interest of the company to chemist-inventor Arthur H. Marks (1874–1939), who reorganized the business (renamed the Skinner Organ Company) and personally oversaw business matters. In 1921, the company purchased and absorbed the John W. STEERE firm of Westfield, Massachusetts. The former Steere factory produced Skinner organs from 1921 until 1929, when economic conditions required its closure.

In 1924, Skinner traveled to England once more, where he met the head of the Willis firm, Henry Willis III (1889–1966). After hearing the young Willis's organs, with their bold and brilliant flue choruses, Skinner returned home convinced that his own organs were lacking in brilliance. In his new instruments, he began using prominent, Willis-inspired upper work. The English influence was strengthened by the arrival of ex-Willis director G. Donald HARRISON, who joined the Skinner firm in 1927 as assistant general manager. Harrison's specified assignment was to assist Skinner in realizing a fully developed English-style ensemble. Their collaborations created some of today's most revered Skinner organs. In 1928, the company installed the landmark University Skinner organs: Ann Arbor, University of Michigan, Hill Auditorium (4/116); Princeton, New Jersey, Princeton University Chapel (4/100); and University of Chicago, Rockefeller Chapel (4/107). Each instrument contained complete Great and Swell flue and reed choruses, Choir mutation families, Solo Tuba choruses, and large Pedals with a Mixture and three 32' stops. In 1929 Skinner rebuilt the Newberry Memorial Organ in Yale University's Woolsey Hall (4/196), the largest organ to bear that company's nameplate.

By 1930, Skinner had begun to question Harrison's increasing advocacy of "classical" concepts. Harrison's control of tonal matters was expanding, with more clients requesting his personal supervision. Attempts at conciliation only inflamed Skinner, who realized he might never regain full artistic control of the company. That year, Skinner sold his company stock and bought an organ factory with the intention of starting a new business with his son, Richmond Skinner. (Located in Methuen, Massachusetts, the property included a concert hall housing the 1863 Walcker organ originally installed in the Boston Music Hall.)

To prevent his departure and loss of prestige to the firm, Marks offered Skinner a five-year, $25,000 contract stipulating only that Skinner remain associated with the company. Skinner signed on in 1931, but again this effort ultimately failed to contain Skinner's anger with Harrison's increasing influence. In 1932, the Skinner Company merged with the pipe organ division of the ÆOLIAN COMPANY to form the ÆOLIAN-SKINNER ORGAN COMPANY. In 1933, after a further series of disagreements over mechanical and tonal matters, Marks stripped Skinner of virtually all control in the company; Harrison was appointed technical director.

Skinner remained contractually obligated to Æolian-Skinner until 1936, at which time he started the Ernest M. Skinner and Son Company in Methuen. This company was moderately active; the high point of this stage in Skinner's career was the instrument for Washington, D.C., National Cathedral (1938, 4/137). The Methuen factory produced its final instrument in 1942; the factory burned down in 1943, but Skinner continued his business in a small way until 1948, when he sold it to employee Carl Bassett.

Skinner clearly articulated his principles throughout an active and influential career. For him, an artistic instrument employed quiet and responsive electric action, high wind pressures, effective swell control, refined voicing, and a fair representation of orchestral color. His 1909 pitman chest was the mechanical foundation of these instruments. His fascination with the orchestra—its repertoire, tone colors, and expressive ability—informed his conception of the ideal organ, and he constantly strove for an instrument that, while not actually impersonating a modern orchestra, might match its expressive powers and evoke its most distinctive colors. He developed many orchestrally imitative flue and reed voices. His organs are regarded among the finest of the American symphonic style of 1900 to 1940.

JONATHAN AMBROSINO

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SLEGEL

German organ-building family of Netherlandish origin. Originally from Zwolle, the Slegels' most significant work was for Westphalian churches. Their instruments generally included a Hauptwerk and Brustwerk, averaging twelve stops, with a pull-down pedal. Jorrien (Jürgen) Slegel I (d. before 5 Mar 1568) became the organist for Zwolle, St. Michaëlskerk, and received a business license in 1539. He built organs for Osnabrück, St. Peter's Cathedral (1545–47; incorp. Eckmann organ, ca. 1751) and Zwolle, St. Michaëlskerk, choir organ (1556; 2/12; dism. seventeenth century). One or both of these were built with the assistance of Cornelis Slegel (d. 1593) and Michiel Slegel (d. ca. 1585), Jorrien's. Cornelis and Michiel built organs for Stadthagen, St. Martini (1559–60); Aalten (1560); Nienburg (1560); Bremen, Unserer Lieben Frauenkirche (1561; lost); and Osnabrück, Marienkirche (1571). Instruments for Hildesheim, St. Andreas and Oldenzaal, St. Plechelmus (Reformed; destr. 1795) are also lost.

Jorrien (Jürgen) Slegel II (d. after 1629), son of Michiel Slegel, worked independently, building a new organ for Lemgo, St. Marien (1587–90; 1/8/no ped, swallow's nest; reb. H. Scherer II or Fritzsche, 1612–13, 2/20; rest. Ott, 1997; now 3/27) and possibly one for Minden, St. Martini, also attributed to Heinrich Mencke (1591; 3/39; rest. G. Steinmann, 1966). As a new citizen of Osnabrück (1592), he rebuilt the anonymous fifteenth-century instrument at the Johanniskirche (1593, 1/8; repl. Berner, 1784). Jan Slegel I (d. before 7 Oct 1604), another son of Michiel Slegel, stayed closer to home, serving as organist at Zwolle, St. Michaëlskerk. He built an organ for Hattem, Gelderland, Reformed (ca. 1570; 1/7; reb. Jan Slegel III, 1677; extant); his instrument for Dortmund, Reinoldikirche (1591–96) is lost. There is no record of Jan Slegel II as an organbuilder.

Jan Slegel III (d. after 1684), grandson of Jan Slegel I, built an organ that exemplifies "progressive overdevelopment," at Kampen, St. Nicholas Cathedral, 1676 (2/14/pull-down; reb. Bosch, 1687, 2/28/pull-down; reb. Hinsz, 1741–43, 2/35/pull-down; reb. F. C. [II] Schnitger and Freytag, 1790, 3/41; reb. Naber, 1865, 4/48; rest./reb. Bakker and Timmenga, 1975; now 4/56). Only six Slegel stops have survived. Besides rebuilding his grandfather's instrument at Hattem, he was responsible for the maintenance of the anonymous sixteenth-century/1656 Jacobus van Hagerbeer organ at Purmerend, Nicolaaskerk (1669–85).

Richard Kassel

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SLIDER

A movable device to put stops on or off, found in tracker and other organs with slider (or "pallet and slider") windchests; it originated in the Classical HYDRAULIS, but disappeared until the fifteenth century. In its basic form, the slider is a wooden (or synthetic) strip or bar, running parallel to the manual, made airtight with a seal made of felt, foam, or plastic. The slider fits snugly below the TOE BOARD supporting the pipes and above the top board of the WINDCHEST. There is one slider for each RANK.

The toe board and top board have an identical set of equally spaced holes, one for each pipe. Each slider possesses a series of similarly located holes that can be positioned so that they align with the top and toe board holes. This creates an open rank or stop; in its other position, the slider blocks the pathway, and the rank or STOP is said to be closed. When a KEY is depressed, pallet valves for the key channel associated with that pitch open. If all four openings are aligned, the route from groove through pallet box to pipe is clear—both KEY CHANNEL and STOP CHANNEL are open—so that a note is produced within that slider's rank. The stop itself might entail more than one rank, front to back, requiring the slider to be correspondingly deeper; but such a slider would be no thicker than those controlling only one rank.

The slider-chest evolved in the fifteenth century, eventually replacing the medieval pin ACTION (which had introduced the spring-pallet and groove, or key channel) and split-chest BLOCKWERK actions. It first appeared in the POSITIVE, and was gradually absorbed by the post-Blockwerk main organ (Hauptwerk). By the sixteenth century, the slider was the standard means of setting stops, even as more sophisticated actions were applied. An important innovation, the DRAWSTOP, acted on secondary valve pallets to allow air into only those stops that were drawn on, while the slider remained the primary determinant of winding. The combination slider and stop-knob became the standard means of controlling organ tone for several centuries, even as spring-chests, balanced and suspended actions, wedge and other BELLOWS types, and RESERVOIRS were experimented with and accepted or dismissed.

In the nineteenth century, reconsideration of the relationship between the stop and key channels led to a desire to eliminate the slider, which sometimes proved difficult to keep airtight within the stop channel, especially with changing atmospheric conditions. In addition, the slider mechanism forced the manual key to function as both action and winding device, and it did not allow for more than the most obvious tonal combinations. (The COUPLER and DIVIDED STOP were limited resources at best.) The first important sliderless (VENTIL) chest was the stop-channel chest. In the cone-chest type made popular by E. F. WALCKER in the mid-nineteenth century, each rank was winded by a separate channel. When a manual key was engaged, a bar to which a set of circularly shaped valves are attached is raised. This opens up small conduits that lead to the toe board and pipe opening; the wind pressure built up in the open stop channel (above the cone valve) escapes through the conduit into the toe board and pipe. While the cone-chest principle was reasonable, it required a greater number of parts and was more vulnerable to damage than the slider-chest.

Pneumatics and, subsequently, electro-pneumatics were applied to the idea of opening channels rather than a series of aligned holes to produce a note; Hilborne L. ROOSEVELT and Ernest M. SKINNER popularized successful approaches, the latter having invented the PITMAN CHEST. By the end of the nineteenth century, the UNIT CHEST concept (in which each pipe is winded separately) eliminated the need for a slider altogether. Even in organs driven by RELAY AND SWITCH SYSTEMS, electricity would operate the key valves while stop sliders were controlled by powerful solenoids. This situation continued with the application of electrical engineering and (later) solid-state circuitry. However, those builders who employed neoclassical, historical, or eclectic approaches after World War II often returned to the slider-chest, taking advantage of its pervasive simplicity of design (and therefore longevity), which when successful makes for precision of attack, compactness, and smoothness of air delivery to pipes.

RICHARD KASSEL

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SLIWINSKI, JAN (1844–1912)

Polish organbuilder. Sliwinski was a pupil and, for ten years, employee of Aristide CAVAILLÉ-COLL in Paris. He founded his own large factory in Lwów (then Austrian Poland), in 1876. Between 1876 and 1892 alone built seventy-nine instruments in the Austrian lands, Poland, Rumania, and Russia, including large organs in Caen, France, St. Pierre; Cracow, Franciscan church; Lwów (now L'viv, Ukraine), Conservatory; Lwów, Our Lady of the Snows; Cherson (now Sevastopol, Ukraine); as well as three other instruments in Poland: Krosno, Franciscan church; Puck Cathedral; and Grybów. Although there is no complete record of his organs, Sliwinski apparently built well over 150 instruments in his lifetime and left several pupils who continued his tradition. His instruments witness to a high quality of his craft, worthy of his great teacher. He also built reed organs.

JERZY GOLOS

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SMENGE, KNUD (B. 1937)

Australian organbuilder of Danish origin. Born in Herning on 12 December 1937, Smenge was apprenticed to the prominent Danish firm of MARCUSSEN AND SON and was later head voicer with Bruno Christensen and Son. Smenge arrived in Australia in 1979 as head voicer for FINCHAM AND SONS, where he initiated major changes in the firm's organbuilding style, best exemplified in the organ at Waverley, New South Wales, Church of Mary Immaculate. He resigned from Fincham and began his own firm in 1981, first in West Melbourne, then moving to North Melbourne, and finally to a factory at Healesville, Victoria (1991). He completed contracts for forty-one new organs in a period of twenty years for clients in all Australian states and Hong Kong.

Smenge's organs are notable for exclusive use of mechanical key action, solid timber cases, mahogany windchests, and a high percentage of tin in pipework, all part of a craftsmanship of an exemplary order. The instruments have a forthright, articulate sound and utilize the principle of open toe voicing: they have been widely used for recordings and recitals. Smenge built three instruments for Perth, St. George’s Cathedral: west organ (1993; 3/46, mech./electric); chancel organ (1994; 2/17, mech./electric), and chamber (continuo) organ (1987; 1/4). Other organs include Sydney, Newington College, Stanmore (1984; 2/17); University of Newcastle Conservatorium of Music; Tasmania, University of Hobart (1990–91; 2/27, mech./electric); South Melbourne, Southgate, St. John’s (1991; 2/23); Crafers, South Australia, Church of the Epiphany (1995; 2/23); and Brisbane, St. Stephen’s Cathedral (2000; 3/47; electric), his last major project. He has also restored instruments such as Brunswick, Victoria, St. Ambrose’s, Sydney Road (1880s William Anderson; 1982; 2/15, mech.); North Melbourne, St. Mary’s, Howard Street (1958 W. Bosch; installed 1983; 2/12, mech.); and the organ recognized as Australia’s first, at Windsor, New South Wales, St. Matthew’s (1840 John Kinloch; 1981–86). Having sold his Healesville factory premises, Smenge now operates on a small scale in Victoria; the firm built a continuo organ for the University of Melbourne, Newman College, in 2002.

John Maidment

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SMITH, BERNARD, “FATHER” (SMIT, BAERENT; SCHMIDT, BERHARD) (CA. 1630–1708)

English organbuilder, probably of Continental origin. The existence of an English house organ by one Christian Smith (1643) has led to speculation that Bernard Smith was a relative who went to the continent during the Commonwealth and returned in 1667. More definitively, he was an organist who came from Bremen to Hoorn, Netherlands (1657); he repaired the Wilhelm organ at Hoorn, Oosterkerk in 1660 (twelve stops; repl. Bätz, 1673). As Baerent Smit(t), he built instruments for Edam, Cathedral (1663; reb. Verhoufstad, 1716; 2/15/pull-down); Edam, Cleinjne Kerk (1664); and Amsterdam, private residence (1665; incorp. Willembroek organ, Ilpendam, Reformed Church). In 1667, Smith emigrated to England, most likely taking advantage of the Restoration’s organ-building boom (and London’s Great Fire the year before).

After repairing and enlarging the organ for Rochester Cathedral (1668), Smith built new instruments at Windsor Castle, royal chapel, 1673 (2/15; to Walton-on-Thames, St. Mary’s, ca. 1800; dism. 2003); Oxford, Sheldonian Theatre, 1670–71 (1/8; to Oxford, St. Peter’s in the East, 1725; dism. 1844); London, St. Margaret’s, where he was organist, 1675 (2/13); and Oxford, Christ Church, ca. 1680 (2/13; reb. Rieger, 1978–79); this last instrument had such continental features as a mounted Cornet and a mixed Chorus. Smith was named the King’s Organ Maker in Ordinary when the incumbent died (1681).

Smith built his first major work for Durham Cathedral, 1683–86 (2/27; dism. 1847), inside a double case on the choir screen; it replaced an unsuccessful 1662 organ by George Dallam, Smith’s first brush with the family of his greatest competitor, Renatus Harris. That rivalry reached its apex with the “battle of the organs” at London, Temple Church. Between 1683 and 1688, the Protestant Smith and Roman Catholic Harris vied for the contract to build an organ there; each built an instrument in the church for judgment. The long-delayed decision featured intrigue, sabotage, one-upmanship, religious overtones (the struggle between James II and Parliament), and a somewhat politicized decision in favor of Smith, who had Henry Purcell and John Blow as advocates. (Ironically, Smith reinstalled a 1685 Harris organ at London, St. James’s Piccadilly in 1691.) The Temple Church instrument (3/23) survived renovation, modernization, and enlargement (1910; 4/60), but was destroyed during the Blitz (10 May 1941; repl. Harrison and Harrison, 1951; extant).

A different battle ensued when Christopher Wren designed the new St. Paul’s Cathedral in London (the Great Fire having destroyed the previous). Smith built its new organ (1694–97, 3/27) while contending with Wren’s refusal to alter the case he had built for the instrument; the resulting altercation led to Wren’s dubbing the organ a “confounded box of whistles.” The organ survived intact until its 1850 rebuild by J. C. Bishop (reb. Willis, 1872, 1960; reb. Mander 1972–77, 1994). The current instrument (5/108) features nine divisions spread throughout the sanctuary.

Other Smith instruments from his later career were for London, St. Clement Danes (1690; 3/22; reb. Flight and Robson, 1804; 4/36); Cambridge, St. Mary the Great (1696; 3/20; reb. Hill, 1870; 3/30; rest. Hill, Norman and Beard, 1963; rest. Mander, 1995–96; now 3/32); Whitehall, Banqueting House (1699; 3/19; dism. 1891); Cambridge, Trinity College (Rückpositiv; 1694; Hauptwerk, 1708; 3/22; reb. Hill, 1870; rest. Metzler, 1975; now 3/42); and Eton College Chapel (1700–01; 3/16). He also built several one-manual instruments at this time. He died in London.

Smith brought northern European thinking, especially concerning reed stops, to England; he adapted easily to the British antipathy for the Pedal, as the Dutch held similar views at the time. Smith befriended John Locke, Isaac Newton, and Christopher Wren, as well as Blow and Purcell. He and Harris (whose Dallam influences led to greater use of mixtures with Tierces) were to some degree stylistic foils to one another, and their work led to British "schools" of building that would persist through the next two centuries.

Although the action of his instruments was once described as "soggy," Smith's contemporary and posthumous reputation was second to none; several attributions of instruments to him have proven untrue or unlikely. Additional confusion arises from his nephews Gerard Smith and Christian Smith, who worked with their uncle briefly before going on their separate ways in the early 1690s; organs built by "Smith" have thus been subject to misattributions. Father Smith's workshop was inherited by his son-in-law, Christopher Shrider (d. 1751), who held royal appointments and built important instruments for London, St.-Martin-in-the-Fields (1726; 3/22; to Wotton-under-Edge, St. Mary, 1799; rest. Tipple, 1995; now 3/31, electropneum.) and London, Westminster Abbey, choir organ, for George II's coronation (1727; 2/17; reb. Shrider and Jordan, 1730, 3/21; case to Shoreham, St. Peter and St. Paul, 1848; reb. Hill, Norman and Beard, 1969; now 2/15).

RICHARD KASSEL

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SMITS

Dutch family of organbuilders. Born to a well-to-do Roman Catholic family, Nicolaas Klaas Smits (b. Reek, North Brabant, 1 April 1791; d. 19 Oct 1831) carried out maintenance work on organs in Maasland, South Holland, from around 1810 on. His brother (Franciscus) Frans Cornelius Smits I (b. 20 Aug 1802; d. 28 March 1876) was appointed organist at Reek, where his brother subsequently built a new organ (1829). In that year, Frans I joined the workshop, continuing it after his brother's death. The brothers were self-taught, having gleaned their knowledge from examining organs in the area and from François BÉDOS DE CELLES's *L'art du facteur d'orgues* (1766–78) and Jan van Heurn's *De orgelmaaker* (1804–5). Frans I brought the business to prosperity, building a few dozen organs between 1831 and 1865.

(Franciscus) Frans Cornelius Smits II (b. December 24, 1834; d. June 2, 1918), son of Frans Cornelius Smits I, took charge of the firm in 1861; he was later joined by his brother Wilhelmus (Willem) Jacobus Smits (b. 24 May 1844; d. 13 April 1929). After their father's death, the brothers continued the firm as Gebroeders Smits. After 1870, the demand for new organs declined, possibly due to competition from Loret Orgelbouw (Mechelen, Belgium) and (later) the German organ factories. Although their production became increasingly industrialized during this period, the Smits firm maintained a high level of craftsmanship. At the turn of the century, Henricus (Harrie) Wilhelmus Josephus Smits (b. 14 May 1871; d. 23 July 1944) and (Franciscus) Frans Cornelius Josephus Smits III (b. 10 Feb 1878; d. 15 June 1928), sons of Frans Cornelius Smits II, began in the workshop. The firm stopped building new organs after 1925, although Harrie continued the maintenance of some Smits instruments.

The organs of Frans I show a remarkable degree of craftsmanship and a great variety of influences from different traditions. Technical details, nomenclature of stops, and composition of mixtures are often highly original. In agreement with their function in Roman Catholic liturgy, even small organs have two manuals, although many instruments still lack an independent pedal. Important surviving instruments include the organs in Gemert (1833), Winssen (1844), Oirschot (1847), Amsterdam, "De Duif" (1862–64, 1882; 3/41), and Tilburg, St. Joseph (1889).

JAN-PIET KNIJFF

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SNELL

English instrument makers. The Snell firm, active in London from the mid-nineteenth through the early twentieth centuries, mostly built REED ORGANS. The details on their lives and work are mostly vague; their careers were marked by frequent changes in location, possibly indicative of a somewhat precarious existence. As early as 1851, Robert Snell of Ball's Pond, London, exhibited a SERAPHINE at the London Crystal Palace Exhibition; it was capable of playing in tune in all keys without the aid of temperament, apparently involving several sets of reeds brought into play by an octave of pedals, one for each tonality. Decorative furniture built by "Messrs. Snell" was also shown at this exhibition, but it is unknown if the furniture makers had any connection to Robert Snell. He was probably the father of the Snell brothers, who established E. and W. Snell in 1864 at Ball's Pond, London.

The firm advertised a "Drawing Room Harmonium" with a five-octave range of five octaves and three stops. A less expensive five-octave "school" model was also available. By 1884 the company was going under the name Snell and Snell Co. (E. and W. Snell), in that same year moving to more commodious quarters at Holloway Road, London. In 1861 Edward Snell invented a "Pedal Substitute" or tirasse-tenuto stop, probably akin to Mustel's *prolongement*, a selective sustaining stop. In 1895, Harry Snell, probably another brother, took additional quarters at Upper Holloway for the manufacture of pianos as well as organs. In 1898 Ed. Snell and Company was making the "Lieblich" and "college" pedal reed organs. In addition to these models, the firm specialized in three-manual organs built to individual customers' specifications.

A correspondent wrote that in 1907 he had bought the last organ that the brothers would make, an instrument of two manuals and pedals. At that time, the Snells were quite elderly, and had apparently commented that this would be their last organ. They apparently ceased operations thereafter. Their instruments had the reputation of being well-built, with rapid articulation and a pipe organ–like tone.

JAMES HOWARD RICHARDS

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SNETZLER, JOHN (1710–1785?)

Swiss-born English organbuilder. Snetzler, baptized Johann Schnetzler, was born in Schaffhausen. He worked with his cousin, Johann Conrad SPEISSEGGER, and may have worked with Christian MÜLLER on the organ for the Bavokerk in Haarlem (1735–39). Snetzler arrived in London around 1742 and set himself up as an organbuilder. His reputation, which came quickly, was enhanced by Charles Burney's favorable recommendation (1754) that he build the organ for King's Lynn, St. Margaret's. It was in this instrument that he introduced London to the Dulciana, using pipes of an inverted conical shape. A prolific builder, he was commissioned by the king to build an organ for Buckingham House (1760). Snetzler, naturalized in 1770, retired and returned to Schaffhausen in 1780, where he died in 1785. His business, continued by Jonathan Ohrmann (from Sweden) and William Nutt, was later taken over by Thomas ELLIOT; in 1815, the firm was joined by William HILL to form Elliot and Hill.

Although all of Snetzler's larger English instruments have either been replaced or drastically altered, his Continental apprenticeship is said to have been revealed by brighter flue choruses, sometimes topped with a mixture without a Tierce, and the addition of stops not normally used in England. While many considered his instruments "delicate and melodious," Samuel Green considered them "snarling and raucous." In all, Snetzler was associated with about 120 organs; a significant number of his chamber organs still survive in more-or-less original condition in England. Snetzler's casework for both chamber and church organs, often of mahogany, was handsome, as were the carved pipe shades and other ornaments.

A fair amount of Snetzler's work was imported into the American colonies during the eighteenth century. His fame there is suggested by a letter from John Nutt in 1768, regarding payment for a sizable organ for St. Michael's Church in Charleston, South Carolina, in which Snetzler is described as "the most considerable and the most reputable Organ Builder in England." In addition to the St. Michael's organ, of which only the altered case survives, there were organs at Cambridge, Massachusetts, Christ Church (1761 or 1764; dism. 1845); Boston, "Concert Hall" (1763; lost); and New York, Trinity Church (1764–65; 3/25/pull-down; destr. 1776). A chamber organ is in the collections of the Smithsonian Institution (1761; 1/5/no ped), and a one-manual organ (1762; 1/10/pull-down) was acquired by South Dennis, Massachusetts, Congregational Church in 1858; it is still in use. A chamber instrument at Yale University, dated 1742 and using the spelling "Schnetzler," is probably by Snetzler, although the earliest instruments known to have been built by him date from 1743 (London, Moravian Institute); it was probably imported in the twentieth century.

JOHN T. FESPERMAN

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SOLID STATE

See ELECTRONIC ORGAN; RELAY AND SWITCH SYSTEMS

SOLO

A grouping of stops, often consigned to a single DIVISION and played on a separate manual, with strong melodic qualities and the capacity of being heard over the PRINCIPAL and similar choruses without blending in. In some instruments, Solo pipes were spread out among several divisions; in others, the Solo chest took the place of the OBERWERK (as well as its function as an ECHO organ) or the BRUSTWERK (the old POSITIV).

The *Solowerk* or Solo organ (a nineteenth-century term) reached its height of development during the Romantic era, but had its precedents as far back as the Regals of the sixteenth-century Brustwerk and the French mounted Cornet mixture half-stop of the seventeenth century. The growing use of manuals with DIVIDED STOPS on led to the further development of the French RÉCIT, which by the eighteenth century had evolved into a separate chest with sufficient wind for strong reed as well as echo stops. The concentration on the individual voice reflected the overall style change, from the contrapuntal German school culminating in Johann Sebsatian Bach to the homophonic Rococo and early Romantic (classical) styles. Within a short time, German and later English builders were creating Solo divisions, often enclosed, with greater emphasis on the strong reeds than the Récit.

The creation of a Solo division saved other divisions from having to compete with often idiosyncratic, generally certainly loud Solo stops. Large nineteenth- and early twentieth-century orchestral organs might feature twenty or more stops in a Solo division (the Wanamaker Organ in Philadelphia has thirty-five), ranging from 16' to 1' and often played on the third rather than fourth manual. But the majority of church organs offered these higher-pressure Solo divisions with a relatively small number of stops—as few as four, on average eight to twelve. These might include large-scale Flutes, Clarinets, Trombone and Tuba, Trumpets (especially the fanfare or gallery stop, sometimes en chamade), and Gambas. In many instruments, 8' registers dominated; in others, there would be greater registral variety and the use of tremulants and mixtures.

The ORGAN REFORM MOVEMENT and the anti-romanticism of post–World War II historically minded builders led to the exclusion of the Solo division from new instruments. However, a revival of the Solo division has been palpable in the last few decades, albeit with adjustments: its use in smaller instruments, sometimes with fewer stops than before; its usurpation of the Positiv or CHOIR in three-manual instruments; its placement in unenclosed chests; and its use in tracker organs, without additional pressure, with a broader selection of stops to choose from than in the past.

RICHARD KASSEL

SORDUN

A 16' or 8' reed stop of the regal class, having short, covered resonators and a soft or muffled tone. It was popular in the seventeenth century in north-central Germany, and still often appears in very small practice organs as the only 16' pedal stop. The term *Sordun* has also been used for a 16' or 8' stopped Flute of soft tone.

See also **Stop**

EDWARD L. STAUFF

SORGE, GEORG ANDREAS (1703–1778)

German organist, composer, theorist, and teacher. Sorge lived most of his life in the Thuringian town of Lobenstein. He had keyboard studies with Caspar Tischner and later studied theology, Latin, oratory, and mathematics. He served as town organist from the age of nineteen on, composing church music and keyboard pieces, including two sets of *Clavier Übung* for organ, harpsichord, or clavichord. Well-versed in the theoretical literature and well-connected in musical circles, Sorge established an impressive reputation as theorist and composer, and was a leading authority on the organ. Four months after Johann Sebastian Bach was admitted as a member (1747), Sorge was invited to join Lorenz Mitzler's Societät der musikalischen Wissenschaften, in Leipzig, a group dedicated to the discovery and explanation of music's scientific and mathematical underpinnings.

In the *Vorgemach der musicalischen Composition* (1745–47), Sorge discovered combination or difference tones, later elaborated upon by Tartini. The *Compendium harmonicum* (1760) describes harmony in terms of the natural harmonic series. He opposed Friedrich Wilhelm Marpurg and Jean-Phillipe Rameau, refuting the idea that a chord can be formed from an undertone. Sorge also wrote on keyboard improvisation, thoroughbass practice, and musical affections. He viewed music, mathematics, and geometry as interrelated sciences.

Sorge's treatises on organ construction attempt to relate mathematics to almost every aspect of instrumental design. Notable contributions are *Die geheim gehaltene Kunst der Mensuration der Orgelpfeiffen* (1760; very influential on the American builder David TANNENBERG) and *Der in der Rechen- und Messkunst wohlerfahrne Orgelbaumeister* (1773). Sorge's most significant contributions to organ building were in issues of SCALING, temperament, and specifications. His theory of scaling appears to be the earliest that utilizes logarithms to find constant dimensions for organ pipes. He also advocated equal temperament at a time when, despite the proliferation of music in virtually all major and minor keys, unequal temperaments were still widespread. He manufactured and sold a monochord that could readily provide measurements in any temperament. While Sorge is rarely mentioned by later writers on organ building, he undoubtedly influenced future practices of scaling and tuning, most notably Johann Gottlob TÖPFER.

See also **Tuning and Temperament**

BRIAN DOHERTY

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SOUND EFFECTS

While the use of an organ or organlike instrument to imitate birdsong is more than two millenia old, the creation of sound effects really begins with the automata of the late medieval period and becomes part and parcel of the water-powered and hand-cranked instruments of the Renaissance and seventeenth century. There were also specialized pipe organ effects like the VOGELSANG, which combined a pipe with a small reservoir of water to re-create a bird's warble. But the major focus during this period was on real percussion, played along with the tunes and figurines by cylinders. This may have resulted in part from European interest in Ottoman culture, specifically the military percussion ensemble named after the Janissary band in which it participated. Janissary instrumentation comprised the Turkish crescent, kettle- and bass drums, cymbals, and triangles, along with shawms and fifes. This music was familiar to Europeans by the sixteenth century and an influence on their music into the nineteenth century.

From their eighteenth-century beginnings, band organ automata included drums and cymbals. By the latter nineteenth century, band organs had switched to cardboard "books" to play a far greater variety of music. The standard percussion component of the band organ remained two drums (snare and bass) and a struck cymbal; more elaborate band organs might also include kettledrum, bells, mallet instruments, castanets, wood block, tambourine, or triangle. PERCUSSION STOPS may have been loud, but it was the high-pressure organ pipes that provided the greater part of the volume.

The THEATER ORGAN was developed in the early twentieth century for the use of human performers to fill in the silence of early film, whether by "cued music" or by realistic-sounding effect, notated into the script by the organist. The switches for some effects were often placed in a console section called the "toy counter." The instrument itself was the beneficiary of several trends in organ building—electrification of the action, increased sophistication of MECHANICAL AIDS, incorporation of "nonmusical" sounds—that gave it remarkable versatility in the production of sound effects, whether produced electrically, pneumatically, or even mechanically. It gave builders renewed opportunities to create new sounds, much as pipemaker s a half-millenium before had experimented with birdsongs and vibrato (VOX HUMANA) effects.

In addition to traps (drum set) and additional orchestral sounds, the well-appointed theater organ would have had a repertoire of "natural" sounds (or plausible imitations developed by the organist): cymbal crashes, sleigh bells, steam whistle, rail crossing bells, telephone ring, ocean surf, horse's hooves, door bells, car horn, police siren, fire gong, drum rolls, thunder, Turkish gong, banjo, and animal noises (e.g., duck, rooster, dog, cat, pig, or lion). Instruction books offered specific cues for screen events—a snore, laugh, yell, scream, or a kiss; even the newfangled airplane was represented, à la George Antheil's *Ballet Mechanique*.

Well-trained organists who played interludes between short films or filled in when the film broke were more likely more appreciated for their soundtrack technique than their musical skills—and not at all appreciated by their "serious" peers. With the onset of the talking film, places outside the theater—pavilions, stadiums, arenas—became the refuges for theater organs, until the maintenance and personnel costs no longer seemed worthwhile to their original owners. (More than one of these instruments have landed in new homes as a HOUSE ORGAN!) They were replaced by taped cues, then digital recordings that provide the requisite number of clichéd sounds (clapping, four-note loops, fanfares) to create the impression that *something* is happening.

Ironically, the invention of computer and MIDI (musical instrument digital interface) technology means that the most skillful composite of instrumental sound, the pipe organ, is now just another "source" to sample, a familiar sound to replicate electronically. Furthermore, that "sound" is most likely to resemble the Hammond B3, which is a half century old—not the organ whose known history is well over two thousand years old, and which has never lost its appeal, however limited its "commercial viability."

See also **Electronic Organ; Mechanical Organ; Toy Stops**

RICHARD KASSEL

SOUTH AFRICA

The first fifty or so years of the Dutch settlement and occupation of the Cape of Good Hope (1652–1795 and 1803–06) were very difficult, and conditions were primitive. Due to these circumstances as well as the ongoing ramifications of the Reformation in Europe, it is certain that there were no organs in southern Africa before 1735. The new Reformed metrical hymnal, which gave great impetus to the acquisition of organs, only came into general use around 1775. The first mention of an organ was the unsuccessful attempt of the Groote Kerk in Cape Town to obtain an instrument from the Netherlands in 1720. (The Johann Jacob Poosen organ for Governor de la Fontaine became the first instrument at the cape.) After the failed attempt by the cape congregation to import an instrument, organs were built from scratch by local builders. Besides Poosen (Posse), active builders during this period were Stephanus Baier (Bauer), Johannes Ludewig Hodderson, Joachem Pieter Leopold, and Gregorius Pentz.

While it is fairly certain that these builders were German, their work had very clear Dutch influences. The ubiquitous VOX HUMANA, use of ivory and ebony for the KEYS, the CONSOLE position, and other elements indicate that, as in Europe, there was an influx of German builders into Dutch areas at that time. Of all of these, Hodderson seems to have been the most successful, and it is fairly certain that most of the many house organs at the cape were constructed by him. Both the first church organs at Groote Kerk (1734) and Strand St. Lutheran (1778) started life as house instruments. The church organs in the cape at that time included a Poosen organ, two Baier organs, two at the Lutheran Church ("klijn orgel" and "la Febre"), a Hodderson at Drakenstein, Dutch Reformed, and another (possibly from Hodderson) at Stellenbosch, Dutch Reformed.

The first English occupation (1795–1803) was largely military, and had no notable effect on local organ history. The same cannot be said for the second occupation, from 1806 to the declaration of the Union of South Africa in 1912. Hundreds of organs were imported during this period. All cathedral, city hall (except Pretoria), and major church instruments are of English origin. Through the entire "golden age" of Romantic English organ building, all major builders were active in the colony. The oldest surviving instrument is the Hill organ in Grahamstown, Wesleyan Church (ca. 1832). Builder presence ranged from more than sixty NORMAN AND BEARD organs to single examples by Abbott and Smith and Morgan and Smith. They ranged from the "monsters" in the city halls to tiny single-manual instruments.

During the transition from Union to Republic (1912–61) South Africa's largest three (after alterations, four) organs were installed. They are (starting with the largest) in Johannesburg City Hall; Pretoria City Hall; Cape Town, Groote Kerk; and Johannesburg, St. Mary's Cathedral. Of these, the Johannesburg City Hall and St. Mary's organs are English. The Johannesburg City Hall organ (Norman and Beard, 1916; 4/97) is the finest ever to come to the country, and remains (even after the unfortunate 1975 Willis rebuild) one of the best instruments south of the equator. The Groote Kerk has the largest church organ in South Africa (1958; 4/70), one of the few examples of work by the Dutch firm Pels en Zoon in the nation. St. Mary's, which started off as a large three-manual organ (Rushworth and Dreaper, 1929; 3/51), added a Choir manual in 1969 (now 4/83). Despite additions made over the years, the original instrument has been largely left alone and can be played as such. Pretoria City Hall contains the gargantuan W. W. KIMBALL (1935; 4/107); this and the organ in the Cape Town City Hall are the only two of this type that are still in original form.

The transition era also marked the low point of the South African organ-building trade. Especially after World War II, the standard for locally built instruments felt precipitously. Numerous organs were built from cheap materials with inferior pipework (often as unit organs) and little or no tonal design or finishing. Even the best of these instruments do not approach the quality of the most ordinary English and American "factory" organs of the period. Fortunately, some of these have been replaced. There was also large-scale importing of MOLLER UNIT ORGANS (most of them very good of their kind) by Cooper, Gill and Tomkins, and E. F. WALCKER organs (of mixed quality) by South African Organ Builders (SAOB).

During the 1960s, '70s, and '80s, organ building improved greatly, with higher-quality modern instruments by Cape Organ Builders, Erwin Fehrle, Fehrle and Roeleveld, Selway Robson, Southern Organ Builders, Gerrit de Waard, and Zielman and De Bruyne. This was true to a lesser extent of the work done by Cooper, Gill, and Tomkins (founded 1902; now named The Organ Builders) and SAOB. A few instruments were imported from Denmark and Germany, but most of the work was executed locally, using imported parts. However, with the departure of Jan Roeleveld in 1994 and Erwin Fehrle's death in 1996, the trade in the country has seen a drastic decline. Byrne Organ Builders, Southern Organ Builders, and Jan Zielman are virtually the only older builders left; the other firms have been dissolved, have merged, or have been reduced to maintenance work only. The young generation of builders consist of Mark Byrne; Ben Humphrey (trained at Beckerath; no longer active); Darryl Kruger (at present working for SAOB); Sebastian Pekelharing, who helped rebuild the 1893 Norman and Beard organ at Port Elizabeth, Feathermarket Hall (3/36; rest. 2000; now 4/87); and David Smit (trained at Charles B. FISK).
See also **Africa**

DAVID SMIT

RICHARD KASSEL

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SOUTH AMERICA

SEE CENTRAL AND SOUTH AMERICA

SOUTH ISLAND ORGAN COMPANY

New Zealand organ-building firm. The South Island Organ Company (SIOC) is located in Timaru, South Canterbury, on New Zealand's South Island. English immigrants Garth Cattle and Vic Hackworthy formed the company in 1968; both had previously worked for the Auckland-based firm of George CROFT and Son, Ltd. John Gray, John Hargraves, and Neil Stocker joined the firm later that year. Currently, the company is under the directorship of Cattle, Hargraves, and Gray. The personnel of the SIOC have much experience in English and New Zealand organ building, but employees have also worked in Australia, Germany, and the United States.

The SIOC is New Zealand's largest organ-building establishment and has more employees than any other similar firm in Australasia. It participates in all facets of the trade, including the building of mechanical and electric action instruments, restoration, rebuilds, on-site work, and tonal overhauls. The company has secured an international reputation for its sympathetic restoration of Victorian and Edwardian instruments; in particular, the labor-intensive rehabilitation of tubular-pneumatic actions has won the firm international acclaim. The SIOC was the first New Zealand builder to restore instruments, using recognized restoration techniques and documentation procedures. Restorations of note include Wellington Town Hall (1906 Norman and Beard; 1986); Dunedin Town Hall (1929 Hill, Norman and Beard; 1995); Melbourne, St. Mary's Star of the Sea (George Fincham's 1899 organ, his magnum opus; 1993); Timaru Basilica (1912 Arthur Hobday organ; 1986); and Christchurch, Blessed Sacrament Cathedral (1878 Halmshaw and Son; 1978).

Major rebuilds include the largest church organ in Australia (Fremantle, St. Patrick's Basilica, 1998) and in New Zealand, organs at Anglican cathedrals in Christchurch (1980), Dunedin (1973), and Nelson (1970), as well as Christchurch, Christ's College (1993) and Wellington, Cathedral of the Sacred Heart (1991). Tracker organs include Wellington, Old St. Paul's (1977) and the restoration and reconstruction of the Pogson organ in the Verbrugghen Concert Hall, Sydney Conservatorium (2001; 3/37). The firm's current project is for Melbourne, Scotch College.

MICHAEL A. COX

Bibliography

South Island Organ Company. <http://www.sioc.co.nz/>.

SPAIN

Up until around 1580, organs in Spain were similar to northern European instruments; thereafter, an independent school emerged. Two or even three manuals were common on large organs everywhere in Spain in the eighteenth century. With a few exceptions (notably the Escorial organs, designed by Flemish builders), pedals were undeveloped until the late nineteenth century, when Jacques-Nicolas Lemmens's *Ecole d'orgue* was introduced at the Madrid Conservatory. In spite of some French classical influence in the nineteenth century and subsequent use of French Romantic technology (including pneumatic actions), Spanish organs changed very little until the ideas behind the German Werkprinzip were introduced around 1970.

Middle Ages

Organs were used in Spanish churches by the tenth century (San Benet de Bages of Vich, 972), and had replaced all other instruments by the thirteenth century (Zamora; Barcelona Cathedral, 1259). The larger organs consisted of a Blockwerk (an indivisible mixture based on 16', 8', or 4' pitch), or were positives with a few ranks of pipes. The slider-chest and reed stop were in use by the early sixteenth century (Roncesvalles, 1507); a full-compass reed rank (Trompeta 8') is present by mid-century (Lérida Cathedral, 1543–45, 1554; see stoplist below).

Toledo Cathedral (Gonzalo Hernandez de Córdoba, completed by Juan Gaytan, 1543-1549)
In this very late example of the Spanish medieval organ, the Compass of its one manual (or possibly two, since there were two chests) was C-a'' (lacking g-sharp'', but with an atypical fully chromatic bottom octave). Chest 1 (Blockwerk): Principal 8', Bourdon 8', Octave 4', Mixture II, Mixture XVI; Chest 2: Principal 8', Mixture; Pedal: twelve or thirteen buttonlike pull-downs permanently coupled to the lowest octave of the Chest 2 Principal 8'.

Like other European Gothic organs, Spanish medieval instruments had variable keyboard compasses (from CC, FF, C, or most commonly F, up to no higher than a''). Pedal keys were short levers or buttons and were useful only for pedal points and occasional notes at cadences, not for playing independent melodies. As the Toledo example shows, registrational possibilities are limited to full organ (Principal chorus, i.e., Mixture, or Lleno), the lowest Principal rank, or both together, with ventils to shut off the air supply to either windchest, under about 90mm (3.5") of pressure. All ranks were of more or less Principal quality and sounded either octaves or fifths. The Spanish organ Case tended to be towerlike (Salamanca; Zaragoza; Daroca, 1488), placed on a transept wall (Toledo), in a side aisle (Tarragona), behind the altar (Daroca), or above the choir (Zaragoza).

Renaissance: Flemish Influence

With the accession of Charles I of Spain—including the Hapsburg possessions of Burgundy and the Netherlands—in 1516, Flemish musical influence became preeminent in Spain, including the area of organ building. Among northern organbuilders active in Spain were Pedro Flamench ("the Fleming"; Barcelona, Nuestra Señora de los Reyes, 1540); Gillis (Gil) and Gaspar Brebos (Breboz; Escorial, 1579–1584); and Jan (Juan) Brebos (Toledo Cathedral, 1592). Flemish influence led to the breakup of the Blockwerk into separate Principal ranks (Flautados) of diverse pitch levels, the introduction of Flute ranks (Flautas) in a parallel chorus, reeds (Lenguctería), Tremulants (temblante or temblor), toy stops, new voicing styles, extended keyboard range (from C, but with a short octave in the bass), slider-chests, and suspended action. A second keyboard for a Rückpositiv (Cadireta or Cadereta) division occurs frequently. The Cadireta is normally based on a Principal rank an octave higher than the Great division (Organo Grande). Full Pedal divisions are rare, though many organs had an octave of pull-downs (eight notes in Castile; seven in Catalonia, with B-natural absent) or even a rank of 16' Contras (basses) on a separate windchest, voiced to balance the Lleno mixture. The pedal keys, however, remain short levers or buttons. The Flemish-built large organs at the Escorial, with their modern Netherlandish pedalboards and Pedal divisions, are exceptional.

Pipes were voiced with open toes well into the eighteenth century. Narrow-scaled Principals with their narrow mouths, low cut-ups, little or no nicking, light wind pressure of 50–60mm(2–2.25") supplied by hand-operated wedge bellows, and high tin content (80 percent or more) were favored, producing a silvery, full, round, rich, and mildly intense sound. Mixtures (Nasardos or Nazartes) sparkle and never scream aggressively. Flutes, scaled wider than Principals, were still relatively narrow. They provided a full chorus to complement the Flautado chorus, and were available in open (abierta) or, most often, stopped (tapada or Flautado Tapado) varieties (including chimney flutes). Stopped ranks at 8' and 4' were normally made of wood. Reeds include Trumpets with full-length conical resonators (8' Trompetas and 4' Chirimías), Krummhorns with variously shaped resonators (Orlos), and short-length Regals (Dulzainas). In contrast to the gentle flues, the reeds are powerful and loud, if not oppressive. Toy stops include bells (Campanas or Cascabeles), birds (Pajaros, Ruyseñor, or Rossignol), drums (Tambor, Tabal, or Timbal, in which two or more pipes are slightly out of tune with each other, creating a rhythmic beating effect), bagpipes (Gaitas), and movable grotesque heads, usually of Moors (Burlador). meantone temperament prevailed.

The facades of Spanish organs usually disguise the interior layout. There are dummy display pipes, even dummy chests in the facade. Since the pipes were arranged chromatically on the chests, elaborate schemes were devised to array the speaking facade pipes in symmetrical patterns. The generous dimensions of Spanish cases probably contribute to the mildness of the flues, as upper partials are absorbed. In cathedrals and collegiate churches, organs were placed on both the north and south walls of the *coro* (choir), with the main facade facing into the choir. In parish churches (e.g., Covarrubias), organs were normally located in a rear gallery on a side wall. Chapels frequently had their own positive organs.

Lérida Cathedral (Matheu Telles, 1543–45, 1554)

Organo Grande (C-a”)		**Cadireta** (C-a”)	
Flautat (facade)	8	Flautes tapades	8
Flautat (rear facade)	8	Flautat	4
Octava	4	Flautes octaves	4
Flautat (stopped)	4	Flautes quincenas	2
Plé (Lleno; Mixture)	XI	Plé (Lleno) Mixture	
Címales	III	Címales	II-IV
Xaramellat*	8 or 4	Claríns de Mar**	8
Trompetas	8	Tremulant	
Claríns de Galera**	8	Tambors	
Pífanos***	4	Ruyseñors	
Campanas			
Tambores		**Pedal**	
Rossignols		8 notes of pull-downs from Organo Grande	
Tremulants			

* Regal? **Trumpet? ***Reed?

Escorial (Giles and Gaspar Brebos, 1579–84)

Organo Grande (bottom manual, CDEFGA-a”		**Cadireta** (top manual, CDEFGA-a”)	
Flautado Mayor	16	Flautado	8
Bordón	16	Pifanos	4
Flautado	8	Flautas tapadas	4
Flauta tapada	8	Quintas	2-2/3
Octava	4	Quincena	2
Flauta abierta	4	Chiflete	1-1/3
Quinta	2-2/3	Lleno	III
Chiflete	1-1/3	Lleno mayor	III
Lleno menor	X	Cascabelado**	I
Lleno mayor	X	Dulzaynas	8
Chirumbela*	I-III	Orlos	8
Bombardas	16	Cornetas	8 or 4
Trompetas	8		
Chirimías	4	Burlador or Gayta (bagpipe)	
		Temblante juego alto (strong tremulant)	
		Temblante juego bajo (weak tremulant)	

Pedal (CDEFGA-d’)			
Flautado mayor	16	Ruyseñor	
Bord	16	Tambor	
Flautado	8	Quitaviento	
Flautado octava	4		
Lleno	X		
Trompetas	8		
Orlos	16 or 8		
Chirimías	4		

*Cymbal? **Bell Mixture

Divided Stops, En Chamade Reeds, and Swell Boxes

The two one-manual organs at the Escorial (also built by the Brebos family) confirmed the divided stop (*medio registro*) as an element of Spanish organ design; four stops were divided (Trompeta 8’, Dulzayna 8’, Orlos 8’ and Flauta 8’), the others were not divided. Stops divided into treble and bass halves with separate WINDCHESTS had been introduced to Spain at Zaragoza, Santa Cruz (1567); an extant Zaragozan organ with divided stops served as the model for Seville Cathedral (1578). Popularized by virtuoso organist Francisco Peraza (1564–98), divided stops and keyboards had become the norm in Castile (but not Catalonia) by the late sixteenth century. Most Castillian organs were altered to divide at c’/c♯, easily accomplished in chromatically laid out windchests. This development made a virtue out of the light wind pressure, otherwise unable to wind more than one family of stops at a time, by keeping the action light (with narrow pallets) and allowing for virtuosic playing in both treble and bass solos, whether using a Lleno combination or a Solo reed, accompanied by the Flautados.

The late sixteenth century also saw the first horizontal placement of EN CHAMADE REEDS in the facade (Duizaina, Huesca Cathedral, 1588). The next known example was installed at Valladolid, Casa Profesa de la Compania de Jesús (1625). The Basque builder José de ECHEVARRÍA I incorporated *en chamada* stops at Eibar, San Diego de Alcalá de Henares (1659); he used them again at Salamanca, New Cathedral (1677), Mondragón, San Juan Bautista (1677), and Tolosa, Santa María (1688), the latter two built with his nephew of the same name. The horizontal full-length trumpets (Clarines) placed in the facade like cannons, intended to give both visual and aural beauty. Such ranks had the additional advantages of being easily tuned, dust-free, and penetratingly brilliant, contrasting even more vividly with the flues and interior vertical reeds (Trompeta Real). These horizontal trumpets are not brashly loud because they have thin wide reeds that enable very fast speech in all ranges. Horizontal clarines postdate Correa de Arauxo’s 1626 collection in which he allows *medio registro* solos in the left hand to be played on the Trumpet, clearly the Trompeta Real. Horizontal trumpets are even more inappropriate for the music of Antonio de Cabezón, who died more than a century before their invention. The first significant Spanish composer associated with the horizontal Clarín was Juan Bautista Cabanilles, who saw to the addition of both a Trompeta Real and a treble Clarín 8 at Valencia Cathedral in 1693.

The Echevarría organ at Eibar possessed another novelty of the seventeenth-century Spanish organ, if not a new invention—the echo or SWELL box. This consisted of a single stop (usually a reed or Cornet) in a closed box whose hinged lid could be opened or closed by means of a foot lever. This lever had to be held down to keep the lid open. A laterally moving, knee-operated, stirrup-shaped lever (*rodillera*) permitted instantaneous switching from the enclosed stop to its unenclosed state. This mechanical aid had, by the mid-seventeenth century, taken the form of ventils that allowed air into a Corneta or Clarín (enclosed or unenclosed) or between Clarines located on opposite facades of the same organ (nave vs. *coro*). An organist could easily play a statement, an echo, and a counter-echo without lifting the fingers from the keyboard.

Both horizontal reeds and swell boxes are associated almost exclusively with Castillian organs until the early eighteenth century. Catalonia, which had enjoyed a short period of independence before its annexation by Spain in 1659, may have consciously resisted changes associated with its occupier. Catalan organs in the late seventeenth century are in fact relatively conservative, innovations limited to an upward extension of the manual range to c''', matching Castile (although Cadiretas still went only to a''); and the use of TIERCE ranks, Cornets, and even mixtures with Tierce ranks, no doubt due to southern French influence; a Cornet was sometimes called Tolosana ("from Toulouse"). Toy stops gradually disappeared in Catalonia, though tremulants were retained. Two manuals continued to be the norm; two-keyboard works were called *partidos*. The Catalan divided stop (*medio rejistro*) placed its division point at b/c', unlike Castile.

The Eighteenth Century

The eighteenth century witnessed an enlargement of the late-seventeenth-century scheme. Organs were built with or were expanded to include two or three manuals (Málaga Cathedral's organ had five), all of them divided, each operating several windchests. The short octave bass disappeared and the manual range was extended upward to g''' on some instruments. In many instruments, pedalboards were still only an octave of pull-downs (chromatic in many cases); others had independent Pedal stops.

Tonally, a diversity of color and effect was the norm. Older Principal choruses were usually retained in rebuilds, as more and varied reeds were added. The left hand often included the horizontal Clarín 8', Chirimía 4', and Violeta 2'; treble en chamade stops included the Trompeta magna (16'), Clarín (8'), and Chirimía (4'). Various Regals imitated old men (Viejos) or old women (Viejas). Wooden pipes virtually disappeared except for an occasional Flauta Traversa, Pedal Contras, and drum stops. The larger instruments might have front and rear facade chests, internal (usually placed on the floor inside the case) and external Cadireta divisions, internally mounted Cornets, and stops in swell boxes. Entire divisions might be enclosed in swell boxes (Cadireta de ecos) or were placed at a great distance as an Echo division. By mid-century, Catalan organs had come to resemble Castillian instruments, with divided stops, horizontal reeds, and swell boxes. Virtually every Spanish organ was "modernized" in the eighteenth century; the 1677 Echevarría organ at the New Cathedral in Salamanca is the oldest playable large organ in Spain, and it too was altered in the twentieth century in an unfaithful restoration. The large organ in the royal chapel in Madrid is one of the few unaltered late Spanish Baroque organs playable today:

Madrid, Royal Palace Chapel (Jorge Bernat-Verí, 1778)

Organo Principal (top manual, c-d3)

Left		*Right*	
Flautado	16	Flautado	
Violón	16	Violón	
Flautado	8	Flautado	
Violón	8	Violón	
Tapadilla	4	Tapadilla	
Octava	4	Octava	
Docequincenovena (2-2/3, 2, 1-1/3)	III	Docequincenovena	
Lleno Mixture	IV-V	Lleno	
Nasardos	III	Corneta Clara	
Corneta Tolosana (2-2/3, 2, 1-3/5)	III	Corneta Tolosana	III
		Flauta Dulce	II
Trompeta Real	8	Trompeta Real	
Fagót	8	Oboe8	
Clarín de bajos	8	Clarín	8
		Clarín	4
Chirimía	4	Chirimía	
Violeta	2	Trompeta Magna	16
Orlos	16		
Orlos	8	Orlos	
Viejos	8	Viejas	

Cadereta Interior (center manual, C-d^3)

Left		*Right*
Flautado	8	Flautado
Violón	8	Violón
Tapadillo	4	Tapadillo
Lleno	VI	Lleno
Zímbala	IV	Zímbala

Nasardos (2-2/3, 2, 1-3/5)	III	Corneta	V
		Flauta traversa II	8
Trompeta Real	8	Trompeta Real	
Bajoncillo	4	Clarín	8
		Trompeta Magna	16
		Chirimía alta	4
Voz humana en ecos	8	Voz humana en ecos	

Temblor fuerte (strong tremulant)

Cadereta de ecos (bottom manual, enclosed, C-d3)

Left		*Right*	
Flautado de Violón	8	Flautado de Violón	
Tapadillo	4	Tapadillo	
Quincena	2	Quincena	
Lleno	III	Lleno	
Nasardos (2-2/3, 2, 1-3/5)	III	Corneta	III
		Octava de Corneta	IV
Trompeta Real	8	Trompeta Real	
Voz humana a la francesa	8	Voz humana a la francesa	
		Tiorba	16

Temblor soave (weak tremulant)
Pajaritos

Pedal (C-B, twelve notes)

Contras	16 + 8*		
Tambor	2 pipes	Timbal	2 pipes

*Permanently coupled
Couplers: Top/Pedal; Center/Pedal
Foot levers for both swell boxes
Ventils for Llenos (Mixtures) of top manual

The Modern Period

The late nineteenth century witnessed the adaptation of French Romantic ideals on some large Spanish organs, and the rare addition of fuller pedalboards and divisions. Some tracker actions were replaced with pneumatic ones (Valencia Cathedral, 1888). Aristide Cavaillé-Coll, who was active in Spain early in his career, installed large organs in such important churches as San Sebastian Cathedral.

The period of greatest destruction of early Spanish organs occurred during the Spanish Civil War (1936–39), notably in Barcelona and Lérida. Since the 1960s, there has been a growing amount of restoration (not always historically appropriate) of older organs. At Daroca (1963–64), Gabriel Blancafort and Joan Capella rebuilt the organ to its 1718 state, but extended the manual range from CDE-c''' to C-f''', applied *medio registro* to an organ that never had divided stops, and adding a thirty-note Pedal division (C-f') with a single 16' pedal rank on its own chest. An example of a new organ is the neoclassical instrument at Ávila Cathedral. Organería Española has provided an "all-purpose" instrument with electro-pneumatic action. Housed in an old case, the organ shows its indebtedness to Spanish traditions while including a full pedalboard and Pedal division as well as elements of North German Baroque and French Romantic styles, so that organists today may play repertoire from these traditions as well. The detached Console is located on the floor in the *coro*.

Ávila Cathedral (Organería Española, 1971)

Organo Grande (C-g^3)	
Flautado	8
Violón	8
Flauta armonica	8
Octava	4
Docena quincena II	2-2/3-2
Lleno	IV
Zímbala	III
Corneta	V
Clarín [facade]	8
Chirimía [facade]	4

Pedal	
Contrabajo	16
Subajo	16
Bajo	8
Principal	4
Bombarde	16

Temblante
Tutti
Couplers (all combinations)

Expressivo (C-g^3)	
Bordón	16
Diapason	8
Flauta	8
Corno gamba	8
Celesta gamba	8
Principal	4
Tapadillo	4
Quincena	2
Decinovena	1-1/3
Zímbala	IV
Churumbala (Cornet)	II
Orlos	8
Trompeta	8
Chirimía	4
Clarín	4

Calvert Johnson

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SPANBALGE

See Bellows

SPEISSEGGER

Swiss organ-building family. Johann Conrad Speissegger (b. Schaffhausen, 22 Aug 1699; d. there, 5 Apr 1781) probably studied with Leo in Augsburg, Germany; he then developed a thriving business in Switzerland. His cousin, John Snetzler, worked with him before emigrating to England. In 1756 Speissegger took a position as an organist in Aarau in 1756, the year he received a contract to build an organ for the Stadtkirche (4/61; case incorp. Kuhn, 1963; mech./electro-pneum.) furthered his reputation. Another Speissegger case, for the organ he built at Büren an der Aare (1772; 2/24), is still preserved in the reconstruction by Metzler (early 1970s). In addition to several smaller organs, he built a number of house organs, including a positive for the Music Collegium of the Chorherren, Zurich (1727); another positive for the Music Collegium in Winterthur (1734), and a small organ for Herrliberg (1732, extant).

His sons followed the profession of their father. Alexander Speissegger (b. Neuenburg, 19 Jan 1727; d. 16 July 1782) was an organist and an organbuilder in Neuenburg. Hans Conrad Speissegger emigrated to the United States; Johann Heinrich Speissegger (1751–1831), was an organbuilder in Zurich; Johannes Speissegger was in America for a few years and then returned to Europe and moved to Vienna; and Hans Georg Speissegger was an organist in Aarau and Schaffhausen.

Douglas E. Bush

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SPERRVENTIL

See Windchest

SPIEGEL DER ORGELMACHER UND ORGANISTEN

A 1511 treatise on organs and organ building by Arnolt Schlick, organist at the Palatine court in Heidelberg. Schlick wrote *Spiegel der Orgelmacher* from long experience as an expert consultant, notably in Speyer, Strasbourg, and Haguenau; he intended the work as a guide for churches that owned organs or planned to build them. *Spiegel der Orgelmacher* provides a vivid picture of the organ at a crucial time in the instrument's development. The most important topics in the book are the organ's stoplist, pitch, and temperament; Schlick also gives advice on the dimensions of the keyboard, dealings with organbuilders, and other matters.

Schlick's lifetime saw the first wide use of slider-chests, which enabled organists to use varying registrations and spurred builders to invent new stops. Schlick praised such inventiveness, but insisted that the stops be musically useful. He counseled against large numbers of similar stops, preferring a relatively small but varied stoplist. His ideal organ, as best it can be ascertained from his sometimes sketchy remarks, would include the following: Hauptwerk: Principal 8' or 16', Octave 4' (even with a 16' Principal), Gemshorn 4', Zimbel; Hintersatz, Rauschpfeife or Schalmei (8'?), "Hültze glechter" (probably a reed; 8'?), and Zink (8'?); Rückpositiv: Principal 4' (wood, or tin voiced to sound like wood), Gemslein 2', Zimmelein, and Hintersätzlein; Pedal: Principal 8' or 16', Octave 4' or 8', Hintersatz, Trompete or Posaune (8'?). Schlick's Hintersatz was a large mixture containing as many as eighteen ranks in the treble; the Zimbel contained fewer ranks and was presumably higher in pitch, though both stops were high-pitched and penetrating.

Schlick recommended a compass of F to a'' in the manuals and F to d' in the pedal. Acknowledging that organ pitch varied from place to place depending on the needs of the singers, Schlick indicated his preferred pitch by means of a printed line one-sixteenth the length of the lowest pipe; the pitch thus implied is about a whole tone lower than the present standard of a' = 440Hz). Schlick described but did not advocate a pitch standard a fifth lower than his recommended pitch.

Schlick's system of temperament, roughly contemporary with Pietro Aron's first description of quarter-comma meantone, resembles meantone systems in that all the thirds are pure or nearly pure at the expense of the fifths. But unlike true meantone, Schlick's system tempers the fifths unequally so that some thirds are slightly better than others. Schlick's temperament includes a WOLF FIFTH (he had encountered keyboards with split keys but considered subsemitones unworkable). Forced to choose between G♯ and A, Schlick preferred the latter: he valued the "strange" sound of the A triad, while G♯ occurred mostly in cadential contexts, where any harshness could be disguised by ornamentation.

Schlick's discussion of tuning typifies his pragmatic approach to organ building. His emphasis throughout the book is on durability and musical usefulness, thus giving churches the best value for their money. In this sense, quite apart from its enormous historical importance, *Spiegel der Orgelmacher* can still be read with profit by organists and organbuilders today.

STEPHEN KEYL

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SPILLFLÖTE

A metal half-covered flute stop of 8', 4' or 2' pitch, which gets its name from its pipe's appearance, which resembles a spindle (Ger. *Spill*). Each pipe has a lower cylindrical portion and an upper conical portion. The length of the conical portion may be anywhere from 1/4 to 1/2 the total speaking length. Traditionally, the top of the pipes cannot be manipulated for tuning, so tuning was accomplished using large ears on either side of the mouth. Contemporary builders often make the upper portion movable for tuning, as is done with the Rohrflöte. The stop dates from the first half of the sixteenth century. Synonyms include *Spillpfeife*, *Spillflute*, *Spielflöte*, *Speelfluit*, and *Spindel Flute*.

See also **Stop**

EDWARD L. STAUFF

SPITZFLÖTE/SPIRE FLUTE/FLÛTE À FUSEAU

An open "pointed" Flute stop from the Renaissance on, pitched from 16' to 1', whose inverted-conical pipes taper gradually to the top (although with a wide variation of ratio to the mouth-line diameter, from 3:4 to 1:5); the pipe is usually metal, although occasionally a pyramidal wood pipe is used. It may be described as a Gemshorn with a sharper taper. Large ears are usually necessary in tuning. A common stop, it often appears under different names. The Spitzflöte is a reedy Flute/String hybrid; its emphasis on lower partials is coupled with the "stringy" upper partials, in some cases too much of the latter. It is a consonant, effective soft Flute solo, and binds strings, flutes, or the two families well. The spire shape is also applied to Gedeckts, Principals, and Quints.

See also **Stop**

SPLIT KEYS

SEE SUBSEMITONES; TUNING AND TEMPERAMENT

SPOTTED METAL

A high-quality alloy of lead and tin, with at least 45 percent pure tin, used in organ pipes. When cast, the surface begins to take on a mottled or spotted appearance. According to George A. AUDSLEY's *The Art of Organ-Building*, pipes made of spotted metal "when of proper thickness are perfectly satisfactory in tone, durability and appearance."

See also **Pipe Metal**

JOHN POWER

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SPRING-CHEST

See Windchest

SQUARE

A small, fulcrum-based device used in balanced key ACTION.

STANDBRIDGE, JOHN C. B. (1800–1871)

American organbuilder of English origin. Born in Birmingham in December 1800, Standbridge came to America with his family in 1807; he eventually graduated from the Pennsylvania School of Medicine. He established an organ-building firm in Philadelphia in 1844, and built a large, three-manual organ for St. Andrew's Episcopal Church there the following year. He was successful, and in May 1854 erected a four-manual organ in the Concert Hall of the Harmonia Sacred Music Society in Philadelphia, said to be the largest instrument in America at the time. Following Standbridge's death in Philadelphia on 14 December 1871, he was succeeded by his sons George O. Standbridge and John H. Standbridge, whose organ for the city's Third Presbyterian Church (1876; 3/33; dism. 1969) was their last surviving intact instrument; one critic considered its case to "border more on orange-crate construction." Standbridge Brothers continued until 1880, when the factory was sold to Hilborne L. ROOSEVELT and became the Philadelphia branch of the Roosevelt Organ Works.

Standbridge organs were said to be well-built, but he did not have an eye for case design; his organs often look squat and disproportional. A few of his larger instruments were built for the Central Presbyterian Church (1855), Cathedral of SS Peter and Paul (1860), and Temple Rodef Shalom (1870), all in Philadelphia. Standbridge enlarged an organ with a Solo division using electric action in 1868, one of the earliest applications of electricity to an instrument in the United States. The Standbridge firm was the most important organbuilders in Philadelphia between 1844 and 1880.

STEPHEN L. PINEL

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STARK

Bohemian family of organbuilders. Andreas Stark (d. 1665), active as an organist and organbuilder, began the family line of organbuilders. His son Abraham Stark (b. Elbogen [now Loket, Czech Republic], 1659; d. there, 18 Mar 1709), also known as "Meister Abraham," likely received his training from Franz Michael Kannhäuser in Falkenau (now Sokolov, Czech Republic) with additional training in Prague. He married in 1695 and opened his own firm in Elbogen, which, after his death, his brother Wenzel Stark (b. Elbogen, 23 Sept 1670; d. there, 16 Sept 1757) continued to operate. Abraham built several large instruments; his reputation was great enough that he was summoned to Prague to rebuild the emperor's organ (4/71). Other instruments include the Cistercian monastery in Plasy (1690); Prague, St. Francis (1688; 2/14; extant) and the Cistercian abbey at Zlatá Koruna, two-manual (2/20) and choir organs (1698–99; choir organ extant); Sedlec, two organs (1690); Prague, St. James (1702; 2/26; case extant); and Staré Brno (1697, now at Snežné). As the founder and leading figure of the so-called Loket school, Abraham exerted great influence on Bohemian organ building, especially builders such as Johann Leopold Burhardt, Johann Franz Fassmann, Johann Ignaz Schmidt, and Johann Joseph Pleyer. His stoplists frequently included 1-1/3' and 1' stops, a Sesquialtera, and foundation stops such as the Viola da gamba, Gemshorn, Quintaton, and various Flute stops. Wenzel Stark built two organs in the church in Most (1741; extant), and one for the church in Zlonice (1746). Johann Josef Stark (b. Elbogen, 1708; d. there, 1780), and Christoph Norbert Stark (1711–1758), sons of Wenzel Stark, as well as Ludwig Stark, likely a grandson of Abraham Stark, kept the workshop in operation until about 1780. Adam Stark (b. Elbogen, 1661), a cousin of Abraham Stark, was also active in the area.

DOUGLAS E. BUSH

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STEERE, JOHN W(ESLEY) (1824–1900)

American organbuilder. Born John Wesley Steer in Southwick, Massachusetts, on 10 April 1824, Steere began organ work with his father-in-law, William A. JOHNSON of Westfield, Massachusetts, in 1856. He left in 1866 to build organs on his own in Westfield and was joined the next year by George William Turner (1829–1908), another former Johnson associate; after two fires and a flood, Steer and Turner moved to Springfield, Massachusetts, in 1879, and the spelling of Steer was changed to Steere in about 1880. Representative of Steere and Turner's work was the instrument at Chicago, Pullman Methodist (1882; 2/23). Steere's sons John S. Steere (1847–1898) and Frank J. Steere (1854–1912) worked with him at various times. When Turner left in 1891, the company, which had built over three hundred organs by that time, became J. W. Steere and Sons. John W. Steere died in East Cambridge, Massachusetts, on 11 December 1900. The firm, renamed the Steere Organ Company around 1919, was acquired by Ernest M. SKINNER in 1921; Skinner rebuilt the 1903 Hutchings-Votey/1915 Steere organ at New Haven, Connecticut, Yale University, Woosley Hall (1928–29).

ARTHUR LAWRENCE

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STEIN, ADAM (CA. 1844–1922)

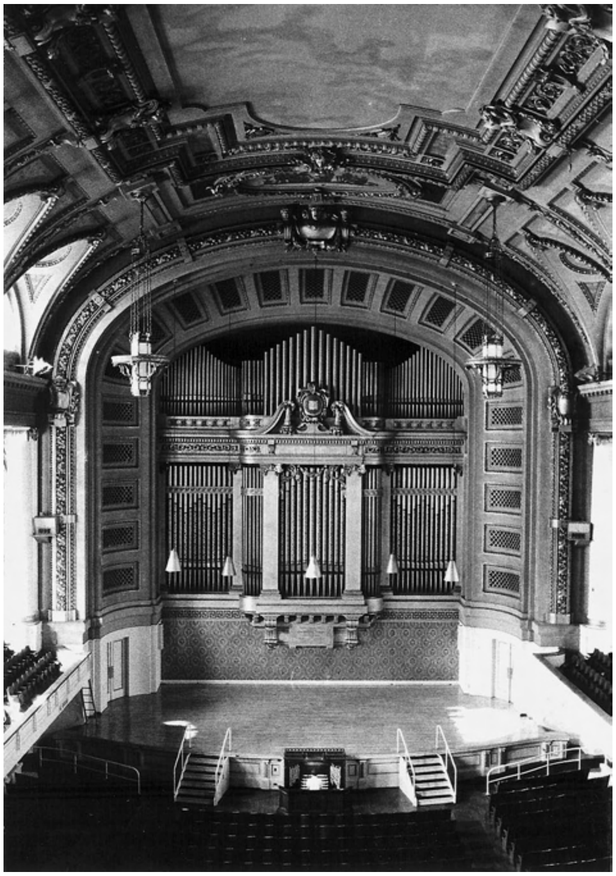

Fig. 72. Steere/Skinner organ, 1915/1928 (4/200); Woosley Hall, Yale University, New Haven.

German-born American organbuilder. Stein immigrated to America around 1857, working first in Baltimore, then in partnership with George Berger in York, Pennsylvania (ca. 1867). By 1870 he was in Westfield, Massachusetts, probably working for William A. JOHNSON. In 1880, he became the manager of the Baltimore branch of Hilborne L. ROOSEVELT's firm. When that branch closed in 1887, Stein moved to New York to work for Frank Roosevelt, remaining there until the company closed in 1893. He then returned to Baltimore, established his own business, and worked there until 1912, when he was succeeded by a son, Edwin A. Stein (?1875–1950). Adam Stein died in Baltimore. Stein organs were well-constructed and a bit forward-looking tonally; their heavy hornlike Diapasons had too little in the way of upper work to add brilliance. The number of instruments Stein built is not known, but most of his clients were located in the Baltimore area. Stein's largest extant organ, built in 1901, is found at Hampden, Maryland, St. Mary's Episcopal.

STEPHEN L. PINEL

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STEINER-RECK

American organ-building firm. It was founded as Steiner Organ Company in 1959 by Phares L. Steiner (b. Lima, Ohio, 18 June 1928), a student of Robert Noehren; first located in Cincinnati, Steiner moved the firm to Louisville, Kentucky, in 1962. In 1967, Steiner was joined by Gottfried C. Reck (b. Warnitz, Neumark, Germany, 28 Sept 1942), who had apprenticed with Detlef Kleuker before emigrating to the United States in 1966. Steiner-Reck works with mechanical action in a neobaroque mode; other instruments have used electric action. Its organs have been installed primarily in the mid-South and Midwest; there are at least thirteen instruments in Louisville alone, including University of Louisville, Comstock Concert (North Recital) Hall (1980; 3/65); Cathedral of the Assumption (1983; 3/43); Concordia Lutheran (reb. 1903 Henry Pilcher's Sons organ; 1984; 2/14); Louisville Presbyterian Seminary (1986; 3/48); and St. John's Evangelical (1987, 3/49). The firm's best-known instrument is at McLean, Virginia, St. Luke Parish Church (1998; 3/46). Described as "a miniature cathedral of copper and chrome," the organ's more than three thousand pipes were imported from Germany. Other works include mechanical action instruments at Mequon, Wisconsin, Concordia University, Chapel of Christ Triumphant (3/63); Lexington, Kentucky, Faith Lutheran (1974; 1/10, playable in three unequally tempered tunings); and Columbus, Ohio, Capital University, Trinity Lutheran Seminary, 1983. An eclectic approach is apparent at Huntsville, Alabama, St. Stephen's Episcopal (2/27), with slider-chests, unit stops, electric action, and MIDI (musical instrument digital interface) compatibility; this post-modern adaptation of the American classic organ "is capable of successfully rendering the vast majority of organ repertoire" while it "serve[s] the music of the liturgy."

RICHARD KASSEL

STEINMEYER

German organ-building family. Georg Friedrich Steinmeyer (b. Walxheim/Württemberg, 21 Oct 1819; d. Oettingen/Bavaria, 22 Jan 1901) studied with E. F. WALCKER before founding a workshop in Oettingen in 1847; his first organ, for Frankenhofen, Evangelical Church (1/10), was completed the followed year. Subsequent instruments by Steinmeyer include Lindau, St. Stephan (1860; 3/43); Fröschweiler (Alsace), Friedenskirche (1876; 2/16); and Munich, Liebfraudom (1880; 3/54). Steinmeyer also built reed organs well into the twentieth century (over six thousand). In 1884, his son Friedrich Johannes Steinmeyer (1857–1928) became a partner; they built an instrument for Oberammergau, SS Peter and Paul (1893; 2/30).

After his father's death, Friedrich Johannes built organs for Frankfurt am Main, St. Matthäus (1905; 3/41) and Mannheim, Christuskirche (1911; 5/92). During this period, Steinmeyer absorbed the workshop of one of its former students, the Nürnberg builder Johannes Strebel (1832–1909), who had also trained with Walcker and Aristide CAVAILLÉ-COLL; the firm would be known as G. F. Steinmeyer and Company (Steinmeyer and Strebel) into the 1950s. Friedrich Johannes's sons Hans Steinmeyer (1889–1970) and Fritz Steinmeyer I began learning their family trade; Hans worked in the United States (1913–20), and would have a significant impact on the American classic organ; he was in contact with G. Donald HARRISON, Emerson RICHARDS, and Henry WILLIS III, among others, and later built an organ for Altoona, Pennsylvania, Cathedral of the Blessed Sacrament (1931; 3/58; rest. Columbia Organ Works, 1992). Hans returned to Oettingen to become a partner in 1920; he collaborated with Friedrich Johannes on instruments (Landau [Westphalia], St. Marien, 1924; 3/85; Berlin, Corpus Christi, 1925, 3/70, two Schwellwerks). He became G. F. Steinmeyer's director in 1928. He directed the completion of the late Romantic instrument at Passau, St. Stephansdom (1928; 5/208; rest. and enl. to 233 stops by Eisenbarth, 1975–81, with five separate chests and two consoles spread throughout the cathedral). It ranked as the world's largest church organ until superseded by Los Angeles, First Congregational (R. David, 1995; 5/265; based on 1931 Schlicker).

Under Hans Steinmeyer, the firm built instruments in locations such as Trondheim, Norway, Nidaros Cathedral (1929–30; 4/139; reb. 1954, 1962–65; now 4/105); Buenos Aires/Mercedes, Argentina, San Patricio (1931; 4/63, electro-pneum. cone-chests); Munich, St. Lukaskirche (1932; 4/72); Buenos Aires, Argentina, Maria Immaculada (1935; 2/27); Lorenzkirche Nuernberg (1937; 5/157; reconstr. 1951; reb. 1985; now 4/140); Bamberg, Hohedom (1940; 3/41); Oettingen, St. Jakobskirche (1946; 3/48); Pforzheim, Franciscan Church (1949; 4/95; rest. Göckel, 1996); Nürnberg-Gostenhof, Dreieinigkeitkirche (1952; 3/48); Wiesbaden, Kurhaus (1954; 3/44; rest. 1988); Haugesund (Norway), Vaar Frelsers (1955; 3/50; electro-pneum.; dism.); Ludwigshafen, BASF-Feierabendhaus (1956; 4/69); Ottobeuren Abbey, Marienorgel (1957; 5/82); Buenos Aires, Argentina, Nuestra Señora del Socorro (1958; 3/28, electro-pneum. cone-chests) Hamburg, St. Michaeliskirche (1960–66; 5/85); Munich, Herkulessaal (1962; 4/75); and Nürnberg, Meistersingerhalle (1963; 4/86).

Hans's son Fritz Steinmeyer II took over the firm in 1967. Organs were built for, among others, Waldshut, Evangelische Kirche (1970; 2/26); Augsburg, Kongresshaus (1972; 4/65); Homburg (Saar), Protestantische Stadtkirche (1972; 3/32); Öhringen, Stiftskirche (1975; 3/47); Bad Kissingen, Erlöscherkirche (1978–79; 3/39; reb. Stumpf and Edouard, 1993; now 3/36); Heidelberg, Heiliggeistkirche (1980; 3/62); Feuchtwanger, Stiftskirche (1982; 2/30); Zurich, Tonhalle (with Kleuker, 1987; 4/68); and Speinshart, Pfarr- und Klosterkirche (1996; 2/26). Since that time, the firm has been under the direction of Karl Göckel (b. 1957), who has led his own company since 1983.

In its restoration projects, Steinmeyer has usually saved older material rather than simply discarding it as others did. Among its projects were Sommerhausen/Main, Evangelische Kirche (incorp. 1740 J. P. Seuffert case; 1875; 2/19; rest. 2000–02); Arnstadt, Neue Kirche (reb. 1707 Wender; 1913; 2/21; Wender and Steinmeyer organs separated and rest. Hoffmann [Ostheim], 1999); Ottobeuren Abbey (rest. 1759–64 Riepp “Heilig-Geist-Orgel”; 1922; 2/27); Bremen, Liebfrauenkirche (reb. 1872–74 Schulze; 1930; destr. 1944); Schwetzingen, Schlosskapelle (rest. anon. 1807; 1974; 1/10); Amorbach, St. Gangolf (rest. and enl. 1782 Stumm; with Klais, 1982; now 4/66); Maihingen, Klosterkirche (rest. 1734–37 J. M. Baumeister; 1988–90; 2/22); and Pappenheim, former Klosterkirche (rest. anon. 1720; 1998; 1/14). The firm has unwittingly been involved in a controversy over a 1736–38 Johann Christoph Wiegleb organ (Ansbach, St. Gumbertus; 3/47) that Steinmeyer had twice rebuilt—in 1884, a “romanticized” organ that Albert SCHWEITZER would praise years later, and, in 1961, a neobaroque instrument. The question is whether the rebuilt Steinmeyer should be retained (the view of the Aktionskreis zur Erhaltung der Steinmeyer-Orgel) or whether a reconstruction of the Wiegleb should take place (the opinion of the Verein zur Förderung der Wiederherstellung der Wiegleb-Orgel von 1738 in St. Gumbertus zu Ansbach). The lines between neoromanticism and the authenticity movement could not have been more clearly drawn.

Steinmeyer was one of the few German Romantic organbuilders to survive well into the twentieth century. The Passau Cathedral organ was seen by Hans Steinmeyer as “the height and end of Romantic organbuilding”; when church authorities asked Steinmeyer to reduce the size of the Nidaros Cathedral in the 1950s, he did so kicking and screaming. The firm continued to build large electro-pneumatic instruments with cone-chests long after the Organ Reform Movement had taken hold. Only after 1967 did the slider-chest and mechanical action become the firm’s preferred technology once more. By the 1990s, the company had built over twenty-four hundred instruments.

RICHARD KASSEL

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STELLWAGEN, FRIEDRICH (CA. 1600–CA. 1660)

German organbuilder. Born in Halle, Stellwagen was the most significant pupil of Gottfried FRITZSCHE, his father-in-law. Stellwagen went with him to Hamburg in 1629; he learned from Fritzsche such practices as planing rather than just hammering the pipe metal, reducing the amount of tin in pipes, adding new reed stops and the Sesquialtera, extending the Trumpet to the 16’ register, and equipping each division with a complete Principal chorus.

Stellwagen settled in Lübeck in 1635, with a workshop near the cathedral. He worked on organs in Brunswick-Lüneburg, Hamburg, Pomerania, Saxony, and Schleswig-Holstein (especially Lübeck). His early work involved repairs, rebuilds, and enlargements; he added a new BRUSTWERK, RÜCKPOSITIV, and PEDAL to the organ at Lübeck, St. Jakobi (1636–37; 2/26). Approximately fifteen Stellwagen stops, Renaissance pipework, and the original case survive; the old chests, rebuilt by him with two transmissions, also exist. This instrument attracted great attention during the early years of the *Orgelbewegung* (ORGAN REFORM MOVEMENT); Charles B. FISK even copied the Brustwerk in his neobaroque organ for Palo Alto, California, Stanford University (1984). Stellwagen continued to maintain and rebuild organs, included Lübeck, St. Marien, main organ (1637–41; 3/54); Mölln, St. Nicolai (1639–41; 3/37; new Brustwerk; pipes extant); Hamburg, St. Katharinen (1644–47; 4/58); Lübeck, St. Aegidien (1648; 4/43; new Brustwerk); and Lübeck, St. Marien, “Totentanzkapelle” organ (1653–55; 3/37). In 1645, he won the maintenance contract for all Lübeck organs.

Stellwagen’s first known new organ was built at Ahrensburg Palace (1639–40; 2/15; pipes extant). Later instruments include Travemünde (1642–43; 2/21; attributed); Salzwedel, St. Katharinen (1650; 3/37) Stralsund, St. Johannes (1653; 2/20/pull-down?); and Stralsund, St. Marien (1653–59; 3/51), which was

Stellwagen's largest project, exemplifying the North German style. After questionable repairs and severe damage caused by Napoleon Bonaparte's troops and during World War II, the organ was restored by SCHUKE (1946–59; reeds completed 1972).

Stellwagen's pipemaking was of the highest quality; he invented the Trichterregal, a soft reed with a narrow, slightly conical resonator ending in a funnel-shaped, half-stopped top. It soon became popular with organbuilders such as Berendt HUSS, P. Landrock, Joachim Richborn, and Arp SCHNITGER. Other characteristics include the overblowing Feldpfeife 2', full-length conical flutes in the Great (replacing stopped flutes), and long reed resonators. He often replaced the Octave 2' with more colorful stops (Nasard 2-2/3', Feldpfeife 2', Sifflitt 1-1/3'), and was especially fond of Quintadenas. Stellwagen's organs fit the northern German WERKPRINZIP, distinguishing each division clearly from the others visually and acoustically. The Great emphasizes the Principals; the Rückpositiv contains color stops and narrow-scaled Principals; the Brustwerk is the "soft" division; and the Pedal provides bass reeds as well as solo stops. The tuning was probably meantone.

Stellwagen represents the continuation of several traditions: the central German school, including Esaias BECK and Johann Lang (1543–1616); Dutch builders working in northern Germany, such as Johannes Gottshalk (d. 1588), Gottschalk Johannsen, called Burkhard or Borchers (d. 1597), and Hendrik NIEHOFF; and north German native builders such as Fritzsche, Jacob Rabe (d. 1609), and the SCHERER family (particularly Hans the Younger). Stellwagen died in Stralsund sometime between 9 November 1659 and 25 February 1660. His students include his son, Gottfried Stellwagen, organbuilder and cathedral organist in Güstrow (after 1664 in Heide/Holstein); Stellwagen's son-in-law, Michael Beriegel (or Briegel), builder of the large organ in Cammin and who, along with his son, David Beriegel, was active mainly in the Lübeck, Lüneburg, and the Mecklenburg areas; Friedrich Besser, active in Brunswick (Braunscheig); and Richborn, who took over Stellwagen's business in Lübeck.

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STERTZING

German family of organbuilders. Georg Christoph Stertzing (b. Ohrdruf, 4 July 1659; buried Eisenach, 21 Feb 1717) grew up in Ohrdruf, where he may have studied organ building with Caspar Lehmann or Heinrich Brunner. In 1691 he began maintaining the organs in Eisenach; he moved his shop there after beginning the construction of the large organ designed by Johann Christoph Bach for the Georgenkirche (1696–1707; 4/58; facade extant). This was probably the largest organ built in Thuringia during the Baroque period; most of it was complete when Bach died in 1703. Stertzing also built a large instrument for Johann Nicolaus Bach at Jena, Michaeliskirche (1704–12; 3/44) as well as a number of smaller instruments. Georg Christoph's largest surviving organ, originally built for Erfurt, St. Peter's (1700–02; 2/27; rest. Schuke), was moved to Büssleben in 1811.

Stertzing worked together with his brothers Johann Christian Stertzing (b. Ohrdruf, 6 Jan 1675; d. 1735) and Johann Friedrich Stertzing (b. Ohrdruf, 21 Nov 1681; d. Kassel, 1731), and later with his son Johann Georg Stertzing (b. Ohrdruf, 1690). Their last organ was for Erfurt, St. Augustine's (1714–16; 3/39). It is not known whether the Erfurt contract was originally signed by the Stertzing brothers or by Johann Georg Schröter. In any event, the organ was considered by Schröter to be his first as master builder; it was examined by Johann Sebastian Bach on 31 July 1716.

Georg Christoph Stertzing's work was highly valued by his contemporaries; his organs were included in the travel itineraries of both Charles Burney and Johann Andreas SILBERMANN. The disposition designed by Johann Christoph Bach in Eisenach is noteworthy for its unusually large number of flute and string stops, a fully developed Pedal division (from 32' to 1'), stops that provide depth of sonority, narrow- and wide-scaled Quints, three-rank Sesquialteras in every manual division, and facade Principals made from "pure English tin." The compass was fully chromatic: C to e''' in the manuals, C to e' in the pedal. The instrument obviously influenced not only J. S. Bach's own ideas about organ building but eighteenth-century organ building in general. This disposition has been re-created in the new Bach organ for Leipzig, Thomaskirche (Gerald Woehl, 2000).

Johann Friedrich Stertzing worked with his brothers in Ohrdruf and Eisenach before moving to Kassel in 1715. He built an instrument for Lauterbach, Stadkirche (1727; 2/18), but is remembered primarily for the extensive rebuild he and Nicolaus Becker carried out on the organ in Kassel, St. Martin's (3/39); J. S. Bach examined the organ and played the dedication concert on 28 September 1732. Johann Christian also worked with his brothers in Ohdruf and Eisenach, and for five years with Johann Friedrich in Kassel; he then returned to Ohdruf. There are no records of new organs built by him.

The Stertzing business in Eisenach was carried on by Johann Georg. Although he built new organs, including the instrument for Eisenach, Nikolaikirche (1717–18; 2/19), his skills did not approach those of his father. He was unable to bring his father's Georgenkirche organ back into good playing condition after it was damaged during a church renovation, according to Johann Bernhard Bach and Johann Friedrich Wender, who examined the work.

Lynn Edwards Butler

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STICKER

In mechanical pin ACTION, a rigid thin wooden (or metal) rod that transmits pushing actions, as opposed to the TRACKER, which transmits pulling actions; also called a striker in eighteenth-century Britain. In an early application (Renaissance), depressing a KEY causes a sticker attached to the bottom of the key's front end to push down and open the appropriate WINDCHEST pallet. In another system, the sticker is attached to the top of the key and pushes a BACKFALL through to the pallet. In PEDALBOARD actions, the sticker is attached under the back end of the key so that, when engaged, it moves a more extensive device to engage the pedal chest pallet.

The sticker was largely superseded with the development of the ROLLERBOARD, using a combination of trackers, backfall, and the SQUARE in the gradual refinement of the pre-Baroque suspended tracker action. Like other tracker actions, it gave way to multiple pneumatic motors and lead tubing to carry the action. With the ORGAN REFORM MOVEMENT of the early twentieth century and the post–World War II interest in centuries-old instruments, the sticker as a component of tracker action has been revived.

Richard Kassel

STOP

A term that refers to (1) one or more ranks of pipes, or (2) the means of controlling the ranks to be heard at any given moment. The term probably comes from the late medieval invention of controls to "stop" certain ranks of the full BLOCKWERK mixture from sounding; hence the semantic oddity of "putting on a stop" to produce sound. A stop can control a single rank or more of similar pipes, or several distinct ranks (MIXTURES and COMPOUND STOPS). DRAWSTOPS or stop-knobs, by which the player controls the stops, may control ranks of pipes ("speaking stops") or can function as COUPLERS or other MECHANICAL AIDS.

Stops in mechanical ACTION organs work as they have since antiquity: drawstops located within reach of the performer are connected via a mechanical link to a SLIDER in the WINDCHEST. When a stop-knob is pulled out, holes in the SLIDER are aligned with those in the RACKBOARD and top boards in the windchest; this allows air to flow to the pipes whose corresponding KEYS are depressed. SLIDERS, and the many sliderless windchest designs, can also be controlled by pneumatics or electricity. The latter permit different kinds of stop controls at the CONSOLE, such as tilted stop tablets, illuminated stops, or reversible pistons. ELECTRONIC ORGAN stops dispense with all mechanical connection, much as they dispense with pipes to produce sound.

See also **Compound Stop; Divided Stop; Flue; Reed**

Alastair Disley
Edward L. Stauff

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STOP CHANNEL

A component of VENTIL WINDCHESTS (*Registerkanzellenladen*), in which, rather than have SLIDERS open or close a STOP or RANK, a particular stop channel (equivalent to a rank, running side to side) is drawn on and supplied with wind. A spring-loaded wire with a disc valve covers each aperture of a KEY CHANNEL; when a key is depressed, the corresponding note will sound in those stop channels that are winded. Two prominent nineteenth-century stop-channel chests were the cone-chest of E. F. WALCKER and other German builders and the pneumatic membrane-chest of Hilborne L. ROOSEVELT, Wilhelm SAUER, and William SCHUELKE. Electrified slider-chests and electronics spelled the end of the sliderless stop-channel ventil chest.

STOP-KNOB

SEE DRAWSTOP

STOPLIST

The stop potential for a particular organ; also called disposition or specification. The stoplist is divided into divisions; each division subdivides its pipes into FLUES and REEDS, with type or register providing further subdivisions. Manual location and compasses are often provided here (or at the bottom of the stoplist). Excepting one-manual or other small organs, the list is divided into two columns. The GREAT division (HAUPTWERK, GRAND ORGUE, Hoofdwerk) is invariably listed at the top of the left column; a PEDAL, when present, can be placed at the bottom of either column. Any special devices (COUPLERS, combination actions, MECHANICAL AIDS) are listed underneath the stoplist.

An organ stoplist may be compared to an architectural sketch, in the sense that it conveys the basic ideas of the tonal architecture, indicates some materials, and provides an overview of the instrument and the foundations of its tonal style. Like an architectural sketch, however, a stoplist goes only so far; only the “blueprints”—a complete “book” of possible stop combinations—and a great deal of experimentation can be used to determine the REGISTRATION. It seems inconceivable that a pipe organ’s stoplist can reveal only bare hints of the sound. Certain effects can be predicted, based on an interpretation of the stop names and choruses; but the precise and full character of the sound cannot be deduced from a stoplist or any other document.

One stands on firmer ground when it comes to comparisons. A Great division from 1910 might contain stops at 8’, 8’, 8’, 8’, and 4’, and a more recent Great might be 16’, 8’, 8’, 4’, 2’, Mixture, and Trumpet; it would be easy to describe the differences between the two. But given two modern stoplists with exactly the same names and pitches, one would be at a loss trying to describe the differences between them. Only until the organs could be heard live would the differences be audible, having no relation to the identical stoplists.

Moving the stoplist to pipe scale information, there would be only a bit more information. The SCALING is closer to a blueprint than the stoplist, but scaling is such an arcane bit of pipe organ data that it would not convey much to an organ committee member or to an organist. Even at that, the scaling and stoplist together do not provide the entire tonal picture. There are more than a dozen parameters of each pipe directly involved with forming the sound, not including what the voicer and tonal regulator might do with the hundreds or thousands of pipes. Organbuilders are frequently surprised by the results of a finished instrument in the complex acoustics of the room. This is part of the mystery and the glory of trying to design a large and complex instrument like the pipe organ for a specific location.

Organists and enthusiasts often treat the stoplist as an all-important, never-changing control of the sound and design of the pipe organ. This may be true of a small instrument; but in a large organ, the builder is striving to obtain the maximum from the funds and space available. Changes in the stoplist are both inevitable and desirable. Hardly any large pipe organ is installed according to the “original” stoplist. The changes themselves can reveal something of the mental process a builder uses to create the design; the builder uses the stoplist to organize thoughts, create a tonal edifice in the mind, test it empirically, and move toward the final design. The reality of making pipe organ stoplists combines having a sound in mind while picking out the stops and allowing for the unexpected when arranging stops in new ways to elicit a mental sonic image.

In the 1930s, Ernest M. SKINNER became nothing more than a figurehead at the ÆOLIAN-SKINNER ORGAN COMPANY, while G. Donald HARRISON was fully in charge. Both Skinner and Harrison continued to supervise Æolian-Skinner organ installations at this time. Skinner raged at both the company and Harrison for abandoning "his" organ. But even modern experts are hard-pressed to find the "extreme" tonal differences between the two that generated such heat from Skinner; even the stoplists look alike. If today we find so little difference, especially when compared to the wholesale and obvious differences they saw in their time, then it is apparent that tonal architecture is a subtlety that can easily elude us, confuse us, and lead us to false conclusions.

The stoplist may not be the total picture and predictor of organ sound one wishes it were, but it is a tool does that helps to explain and convey certain concepts to those (such as clients and committees) who wish to understand what the organ is (or will be) all about. The stoplist is a useful and convenient crutch, and it will survive as the simplest way to categorize and contract for the organ.

CHARLES HENDRICKSON

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STOPPED DIAPASON

A stopped rectangular wood Flute on the manuals, usually at 8' pitch (occasionally 4' or 16'); sometimes called a Stopped Flute, Tapadillo, or Gedeckt. It may be the only available stopped rank on smaller instruments. The capping serves to emphasize the first, third, and (to a lesser degree) fifth partials; despite a mild, even dull timbre without chiff, its harmonic richness is often effective when added to the open 8' Diapason stop and is generally useful in combinations.

See also **Diapason**

STOPPED PIPE

A FLUE pipe (wood or metal) in which the top of an open RESONATOR has been completely sealed by a movable stopper or cap or by a soldered-on cap. (The term *resonator*, while usually applied to reed pipes only, is sometimes also used for the upper part of a flue pipe.) Stopped pipes produce a note approximately equal to an open pipe twice its length, thanks to the "doubling back" of the standing wave of wind before the pitch is resonated and sound exits the MOUTH. This phenomenon has helped keep spatial, monetary, and other considerations from crippling the lower end of an organ's REGISTRATION. Another result of stopping is an emphasis on odd-numbered partials, much like an orchestral clarinet. Movable stoppers or caps can be used for VOICING and tuning, while fixed caps require the use of EARS and other devices around the mouth for the same purposes. Among the more common stopped flue pipe categories are the many Stopped and Gedeckt (Gedackt) stops, some Flutes, Quintadena (Quintade), Nasard, Bourdon, Sordun, and Subbass; in Spanish, stopped pipes are prefixed *Tapada*.

To stop a metal pipe at the top, a cap whose diameter is larger than the pipe is fit over the resonator. Felt lining covers the inner rim of the cap to prevent rattling as the air bounces around the resonator; when folded over the rim, the felt becomes visible from outside, forming a kind of distinctive band for this kind of pipe. The stoppers of closed wooden pipes are usually fitted with a LEATHER pad to seal the resonator. The stopper fits inside the pipe body; a handle or cord is attached to its top to adjust depth in the voicing process.

Half-stopped flue pipes allow some air to escape from the top of the resonator, so the doubling of the sounding length does not fully apply. As a result, the stopped pipe's clarinet-like emphasis on odd-number partials is eased by the inclusion of even-number partials, adding flutelike qualities to the sounds. In the case of wooden pipes, the resonator can be partially closed by covering the top of the pipe with a piece of metal attached to one side; the metal flap is rolled back (scrolled) to uncover the pipe's top partially. Another method involves closing a resonator with a full stopper that has a chimney-like handle, through which a hole has been bored to allow the air to escape (ROHRFLÖTE). There are two principal types of half-stopped metal flue pipes. The metal chimney pipe is actually more common than its wooden analog; sometimes its cylinder (chimney) extends farther down into the resonator. Alternately, the cap over the top of the pipe is made in a conical shape, with an opening at the upper (smaller) end of the cone (KOPPEL/KOPPELFLÖTE, SPILLFLÖTE).

See also **Haskell Bass**

RICHARD KASSEL

STRAND, PER Z(ACHARIAS) (1797–1844)

Swedish organbuilder who learned organ building from his father, Pehr Strand. In 1820 Strand and his colleague Gustaf Andersson were sent by the Stockholm Royal Academy of Music to study organ building in Germany with von Knoblauch in Dresden and J. G. Mende in Leipzig. He returned to Sweden in 1822, took over his father's workshop, and in 1824 graduated as an organbuilder and was chartered by the Royal Academy of Music. He worked as an organbuilder until his death in Stockholm.

Strand stands as one of Sweden's most important builders, both technically and musically. From his training in Germany, he introduced an instrument in the new Romantic style. Typically, his organs contain an abundance of foundation stops, including strings and flutes, while mutations and mixtures are absent. He built about seventy organs (twenty of which survive); among them are the organ for Gryt (1835; 2/17; rest. Mäkinen and Gripentrog); his largest instrument was built for Lund Cathedral (1836; 4/61). Two instruments were erected in Finland, one in Hämeenlinna (1819) and another in Loviisa (1841; destr. 1855). Toward the end of his life his struggles with alcoholism made it difficult for him to complete his work; he was awarded the contract for a new organ at Söderköping, St. Lawrence, but the contract was later rescinded and given to Sven Nordström.

Douglas E. Bush

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STRING

Flue pipes imitating or reminiscent of the sound of bowed instruments; in the first group, the Viola, Viola da Gamba, Viole d'Orchestre, Violoncello, and Contrabass, appearing first in eighteenth-century German organs and spread over all Europe; in the second, the Salicional, Gamba, Aeoline, and the Céleste group. The pipes of string stops are narrow-scaled; they are thus very difficult to voice without destabilizing their tone; for this reason, builders add Ears and Beards to hinder the formation of vortices at their mouths. At least one string-toned stop is present in almost all the organ specifications of the nineteenth century. The Violin stop was usually treated as a Half-Stop, limited to the keyboard's upper compass. In general, all string-toned stops in Italian organs were divided, as the choruses of string-toned pipe ranks became common from the end of the century. Organbuilders tried to enhance their tone by adding the Vox Humana (Voce Umana) vibrato.

In the era of the orchestral organ, builders such as George A. Audsley, Robert Hope-Jones, and Ernest M. Skinner began to group stops into orchestral "families," including a String division. Larger organs tended to incorporate String subdivisions within Orchestral divisions. Emerson Richards's design for the Midmer-Losh instrument in the Atlantic City, New Jersey, Convention Hall (1929–32; now Boardwalk Hall) includes three String Organ divisions among its twenty-two divisions.

Although the Clavierorganum was built in various places and ways, the use of a real stringed instrument as part of an organ was extremely rare. One example is the Cavalieri di Malta church organ built by Azzolino B. Della Ciaia (Pisa, 1738), in which a harpsichord was inserted as a fifth keyboard.

Marco Tiella

STUART

American organ-building family. The most important member, Levi Underwood Stuart (b. New York, 27 Jan 1827; d. Bronx, NY, 28 Apr 1904) apprenticed with his half-brother, New York builder Richard M. Ferris, himself an apprentice of Thomas S. Hall and Henry Erben. Stuart and Ferris went into partnership in 1857, but Ferris died a year later, and Stuart continued as Ferris and Stuart for a few years thereafter. Stuart was associated with Ferris's "largest and best" instrument, an organ for New York, Calvary Episcopal, 1847 (3/32). He renovated the instrument in 1868; it was altered further when it was acquired by and installed at the Malta, New York, Round Lake Association, then a Methodist summer camp, in 1888 (rest. Andover, 1977).

Among the earliest organs by Stuart alone were a small instrument for New York City, Chapel of the Free Gospel, 1859; when the chapel building was sold (1866), its organ was moved to New York City, Holy Apostles. Both the Stuart and another organ were sold the following year and replaced by another Stuart (two manuals; reb. L. C. Harrison, ca. 1886); traded to offset part of the cost of a three-manual Jardine (1895), it disappeared thereafter.

Stuart built more than one hundred instruments, almost exclusively on the foundation stop principle. He installed three-manual organs at Newark, New Jersey, St. Mary's (1858; Italianate case); New York City, Broadway Tabernacle, 1859 (reb. 1864; 3/34); Norfolk, Virginia, St. Mary's; and New York City, Holy Trinity. Ironically, the surviving two-manual instrument at Cold Spring-on-Hudson, New York, Our Lady of Loreto (1872), has a Mixture stop. In later years, he established a repair shop in the Bronx, New York.

Four of Levi Stuart's brothers were also in the organ-building trade. The most significant was William J. Stuart, a voicer and reed pipemaker who worked for Erben and then Ferris. He worked with Levi until 1891, then moved to Albany, New York, to start his own workshop. He rebuilt an anonymous organ from the 1860s at Coxsackie, New York, St. Mary's (added Pedal; 2/25). William remained in business until around 1913. Louis (Lewis) J. Stuart was also a Ferris apprentice, and remained in Levi's firm until 1884, while Henry C. Stuart worked there until about 1891. George J. Stuart, another Ferris student, outlived his brothers; he apparently took over the Bronx repair business when Levi died, and operated it until about 1915.

Levi Stuart was a typical smaller builder in the New York market dominated by Erben, George JARDINE, ODELL, and Hilborne L. ROOSEVELT. But his work was praised—especially the Broadway Tabernacle organ. His association with the Round Lake organ has etched his name into nineteenth-century American organbuilding history.

RICHARD KASSEL

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STUMM

German family of organbuilders. Active for six generations, the Stumm family was active in Rhaunen-Sulzbach, Hunsrück (Rhineland-Palatinate). This region was one of cross-fertilization between French (Lorraine), Luxembourger, and southern German organ building. Generations of family members worked side by side, and attributions to specific Stumm builders can prove difficult. Nevertheless, the Stumm firm installed at least 370 organs (of which some 140 well-built specimens survive), mostly for the Rhein-Mosel region.

The family's most important builders were Johann Michael Stumm (b. Rhaunen-Sulzbach, 10 Apr 1683; d. there, 22 Apr 1747), his sons Johann Philipp Stumm (b. Rhaunen-Sulzbach, 24 Aug 1705; d. Kastellaun, 27 June 1776) and Johann Heinrich Stumm (b. 1715; d. Rhaunen-Sulzbach, 23 Aug 1788), and Johann Heinrich's sons Philipp Stumm (1734–1814) and Franz Stumm (1738–1819). Johann Michael, originally a goldsmith, installed his first organ at Münstermaifeld in 1722 (2/22). His earliest surviving instrument is at Rhaunen Lutheran Church (1723); later organs include Karden, Monastery (1728; 3/37; extant); Leutesdorf (ca. 1735; 3/28; extant); and the royal chapel at Mühlheim/Eis (ca. 1735; 2/23). By 1737, his sons were involved in the workshop, and the company became Johann Michael Stumm und Söhne. Johann Michael's last instrument was again for Rhaunen; it was completed by his sons after his death.

Johann Philipp and Johann Heinrich Stumm formed Gebrüder Stumm; among their firm's instruments were Simmern/Hunsrück, St. Stephani (2/27, extant); Koblenz, Liebfrauenkirche, 1751 (3/43); Bechtolsheim, Simultankirche, 1757 (2/26; extant); Saarbrücken, Ludwigskirche, 1762 (3/38); and Meisenheim, Schlosskirche, 1764 (2/30; extant). Philipp and Franz Stumm (the "third generation") joined the firm in the 1760s; they worked with their father after Johann Philipp's death, building the organs at Frankfurt am Main, Dreikönigskirche (1781–83; 2/29) and Amorbach/Oberwald, abbey church (1782; 3/46; partly extant). Philipp and Franz completed the instrument at Frankfurt, Katharinenkirche (1778–89; 3/40). The most impressive moment in Stumm's later history involves Felix Mendelssohn, who took great pleasure in the firm's 1785 instrument at Neckargemünd, St. Ulrich, and played his organ sonatas on it for friends.

Stumm was quick to develop its trademark qualities: a bright melodious tone, slightly strident Principals, strong reeds, and narrow scaling (when compared to Silbermann). While Stumm was in the forefront and popular in its region in the eighteenth century, the company never made a complete transition from the Baroque to the Romantic organ, instead remaining tied to Rococo aesthetics; a fourth-generation Stumm in Geisenheim/Rheingau (1839) was described as being designed for "ballet-style music" rather than for the music of Johann Sebastian Bach. For all its good qualities, the Stumm organ remained an old-fashioned Baroque organ at heart, unsuitable for the repertoire or tastes of the nineteenth century. The family's last builder, Gustav Stumm (Kirn), died at the turn of the twentieth century; his workshop was purchased by OBERLINGER.

RICHARD KASSEL

STURM/STORM PEDAL

SEE DONNER/STURM/STORM OR THUNDER PEDAL

SUBSEMITONES

Extra accidental keys, with corresponding key channels and pipes, added to the standard twelve-note KEYBOARD octave; selected manual (and sometimes pedal) keys are separated into front and back halves (or more rarely, divided lengthwise), with each half controlling a separate pallet.

Historical keyboard instruments with more than twelve notes per octave have often been viewed merely as speculative experiments. Some such efforts, involving octaves of thirty or more notes, were admittedly impractical. Far more common, however, was the addition of one or two subsemitones per octave, with divided accidentals at D♯/E♭ or G♯/A♭ (often both) serving to extend the usefulness of 1/4-comma meantone temperament. The D♯ and A♭ were originally introduced not to enhance the possibilities for independent solo music, but instead to resolve specific difficulties, mentioned in numerous sixteenth- and seventeenth-century sources, related to the combining of organ and choir in alternatim performance. For example, church modes 3 and 4 (Phrygian, with E as the "final," or modal center) required D♯ as a leading tone; but in an organ tuned in 1/4-comma meantone, the existing E♭ was 41 cents too high to serve as D♯. Choirs frequently transposed Dorian (D) chants to F, but the organ's G♯ was 41 cents lower than the A-♭ called for by the transposition. Compromise tunings of the accidentals in question were perforce unsatisfactory, and several authors, including Jean Denis II, Guillaume-Gabriel Nivers, and Michael Praetorius, make graphic reference to the discord and cacophony that sometimes ensued when separate D♯ and A♭ were not provided.

The use of subsemitones in the organ may have had its start in Italy. The earliest organ known to have subsemitones was constructed for Bologna, San Petronio (epistle organ, 1474–83); the builder, Lorenzo da Prato, provided subsemitones at G♯/A♭ in three octaves of the manual keyboard. Subsemitones are documented in the 1480 contract for a new organ at Lucca, San Martino. The temperament originally employed in this instrument cannot be identified with certainty (as is also true of the San Petronio organ); but the Lucca contract called for "the [major] third above B♮ [D♯] and the minor third above F [A♭], together with their octaves where necessary" (see Lindley). Aaron (1545) laments that most Italian organs still lack subsemitones for D♯ and A♭, though he does note the provision of A♭ in certain "organi moderni." By the 1570s, such arrangements had apparently become more common in Italy; Salinas (1577) writes that "the Italians employ at least two Dieses in every octave . . . the purpose being to provide a common meeting ground between organist and choir. I have very often played on organs of this kind. . . . These two notes [D♯ and A♭] will allow organists to match all the harmonies produced in choral music." It is clear in these and most subsequent discussions that the temperament involved is 1/4-comma meantone.

Comparable developments were also under way in northern Europe. At least one instrument with split keys in both manual and pedal was known to Arnolt Schlick (*Spiegel der Orgelmacher*); Michael Praetorius (*Syntagma Musicum* II, 1619) describes several instruments equipped with subsemitones in manuals and pedal. Similar arrangements were common elsewhere in Germany, generally at important churches or court chapels where "professional" organists served (see Klotz); Jacob Praetorius and Samuel Scheidt both had such instruments at their disposal. Though subsemitones seem never to have gained favor in France, their use persisted in Germany and other European countries through the end of the seventeenth century. In the second edition of his *Orgel-Probe* (1698), Andreas Werckmeister makes reference to keyboards with "the conventional three or more subsemitonia," though he characterizes them as "piecemeal patchworks."

From that point on, the increasing adoption of circulating irregular temperaments (which offered enharmonic equivalence for all accidentals) obviated the need for provision of subsemitones. Virtually no antique organs survive with original subsemitones, since they were nearly always removed in the course of later rebuildings. Subsemitones have been successfully employed in several recently constructed instruments, including those by John Brombaugh (Oberlin [Ohio] College, 1981) and Charles B. Fisk (Wellesley [Massachusetts] College, 1981).

Divided accidental keys were also widely used in short octave arrangements, most often to provide for F♯ and G♯ in the conventional C/E short octave.

See also **Keyboard; Tuning and Temperment**

Vincent J. Panetta

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SUISSE, HANS (D. CA. 1543)

German organbuilder; also spelled Süss, Süst, Svijs, Suys, Züss, Zwits, and so on; he was also known as Hans Blangz. Suisse was an important Renaissance organbuilder sometimes identified with the cognomen "von Nürnberg" (1498, 1509) or "von Köln" (1500, 15067, after 1511), though his name could suggest Swiss origins. He may have been born in Nürnberg; he moved to Cologne, where he was granted citizenship in 1516. His documented activities show him working at the Cathedral, Frankfurt am Main (1498), St. Michel, Liège (1500, 1513), Strasbourg Cathedral (1506–7, 1511–12, 1516), Notre Dame Cathedral, Antwerp (1509–14), St. Nikolai, Kalkar (1515–16), Xanten Cathedral (1518), and the Oude Kerk, Amsterdam (begun 1539), where he collaborated on a large organ (3/25) with Hendrik NIEHOFF (its specification is given in the *Opera Omnia* of Jan Pieterszoon Sweelinck, who played it). Suisse died in Amsterdam.

Suisse qualifies as one of the great masters of Renaissance organ building, and he enjoyed considerable fame during his lifetime. While he was an acknowledged master in building organs that espoused established traditions, particularly in the beauty of his Principal choruses, he also embraced the innovations that appeared in early-sixteenth-century organ building in southwestern Germany (reed stops with full-length resonators, Horn mixtures including Tierce ranks, and narrow-scaled flue stops). His organs, possibly starting with Antwerp, Notre Dame (built by "Hans von Köln") and continuing through to Amsterdam, Oude Kerk, had a decisive influence on organ building in the Rhineland (below Cologne), remaining the standard in northern Brabant throughout the next century.

DOUGLAS E. BUSH

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SUPEROCTAVE

SEE FIFTEENTH/SUPEROCTAVE

SUSPENDED ACTION

SEE ACTION

SWALLOW'S NEST

(Ger. *Schwalbennest*; Fr. *nid d'hirondelle.*) An organ case suspended on (built into) a wall, with no support underneath it other than the wall itself; in smaller churches, a structure wedged into the space between the tops of pendentives supporting a dome. The name stems from the way that swallows build their nests (i.e., as opposed to birds who use trees or eaves). By the fourteenth century, organbuilders were placing entire instruments in such structures, including the CONSOLE, ACTION, winding device, and PIPES; organists and their assistants either climbed ladders or stairs (often hidden behind the wall) to reach the instrument. Besides the symbolic nature of a "floating structure" (heightened when the chest wings were opened during performances), a swallow's nest organ could be located near the chancel (where altar, clergy, and chorus stood) while a large gallery organ is located at the opposite end of the church. The swallow's nest was popular in the Renaissance and (to a lesser degree) the Baroque era, but increasing instrument size eventually made such structures impossible; the gallery organ was dominant by the eighteenth century.

The world's oldest playable organ, now at Sion, Switzerland, Notre-Dame-de-Valère (anon., ca. 1435), rests in a swallow's nest on a wall. The date of this structure is unknown, and the organ probably functioned as a floor instrument at first, given the detail of the paintings on the inside of the wings. Many believe that the instrument came from an abbey at Abondance, Haute-Savoy, suggesting a cultural link with eastern France, where the swallow's nest organ was popular. Alsace builders were especially fond of the type, and emphasized the Cornets and Fournitures to gain the most impressive sonorities possible in small instruments. Their instruments often featured automatons and accessory stops, an amusing if odd synthesis between sacred and secular.

Among this type of organ in France are: Paris, Notre-Dame (ca. 1330, anon.; lost); Strausbourg, Notre-Dame, Conrad von Rothenburg (ca. 1385; reb. A. Silbermann, 1713–16; reconstr. A. Kern, 1981; now 3/47, mech.); Embrun, Notre-Dame, Pierre Marchand (ca. 1460–80; reb. Eustache, 1632, positive added; reb. Gonzalez, 1952; electric pedal; now 3/32); Lorris en Gâtinais, Notre-Dame (anon.; ca. 1501, 1/11; rest. M. Koenig, 1974); La Ferté-Bernard (Perche Sarthois), Notre Dame des Marais (E. Baudot; 1501; rest. Renaud-Menoret, 1986; now 2/19, mech.); Metz, Cathedral (Jehan de Trèves; 1537; 2/11; reconstr. M. Garnier, 1981); and Sarlat-la-Caneda (Dordogne), Cathédrale St.-Sacerdos (J.-F. L'Epine; 1752; 4/35; rest. Haerpfer-Ermann, 1963). Even Corsica had a swallow's nest organ at Rogliano, St. Angel, Giuseppe Lazzari (1761); an official "monument historique," it has been unplayable since the latter nineteenth century. France's most famous swallow's nest organ may be one that was never built: in 1869, Aristide CAVAILLÉ-COLL proposed a giant organ "en nid d'hirondelle" for St. Peter's in Rome. It was to have five manuals, pedal, and 150 stops, including 32' Montres. He spent the rest of his life trying to convince the Vatican to approve his plan, to no avail.

Swallow's nest organs were built in other European countries. They achieved their greatest popularity at the end of the sixteenth century, but became impractical for the same reasons as elsewhere: larger churches and instruments. An organ built by Hans BREBUS at Næstved, Denmark, St. Peter's (ca. 1586), was dismantled and eventually incorporated in a nonfloating MARCUSSEN AND SON INSTRUMENT (1960, 3/32); some have called for a reconstruction of the Brebus in its original position. Another, at the Ribe, Denmark, cathedral, was originally a swallow's nest organ (1635), but was turned into a gallery instrument during a rebuild (1766–67). Restorations of German swallow's nest organs include: Lemgo, St. Marien (J. Slegel; 1587–90; 2/20; rest. P. Ott, 1947–50; rest. M. Ott, 1997; now 3/27) and Bedheim, Kilian-Kirche (Nikolaus Seeber; 1721; 2/15; rest. Schuke, 1994–96; now 2/18). Less fortunate is the Leipzig, Thomaskirche, swallow's nest organ used by Johann Sebastian Bach. This second organ (3/21) rested on the east wall, and was played in the premiere of the revised *St. Matthew Passion* in 1736. However, that organ was considered irreparable by 1740, and was demolished.

Spurred on by the ORGAN REFORM MOVEMENT and its later manifestations, European organbuilders have restored and reconstructed swallow's nest organs; North American as well as European builders have also built new instruments into these Renaissance-style cases, sometimes with detached consoles. One prophetic example stands in St. Etienne (Loire, Rhône-Alpes), St. Charles. The choir organ, apparently built by the Swiss firm Tchanun, has its console on the ground and its pipechests in a swallow's nest (1930; 2/11, electro-pneum.). After 1960, new examples began to appear more frequently: Freiberg Cathedral (Marcussen and Son, 1965); Trier Cathedral (Klais, 197; Worms Cathedral (Klais, 1985; 3/34, mech./electric, Schwellwerk); Purchase, State University of New York, Recital Hall (Rieger, 1979; 2/27, mech.); Cologne Cathedral (Klais, 1998; 3/53, mech./electric); Frankfurt am Main, Alte Nikolaikirche am Römerberg (Oberlinger, 1992; 2/23); Antwerp, Notre Dame Cathedral (Metzler, 1993; 3/45; neoclassical); Sitka, Alaska, Lutheran Church (Pasi, 1993; rest. 1844 Kessler organ, Tartu, Estonia); Durham, North Carolina, Duke University, Memorial Chapel (Brombaugh, 1995–97; 2/23; Italian Renaissance, best-known American swallow's nest); Brussels, Cathedral of St. Michael and Gudula (S. Platt, 2000; Reims, Basilique St.-Rémi, Cattiaux, 2000; 3/43); and Bron, St. Paul (Verschueren, 2002).

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SWARBRICK, THOMAS (D. CA. 1753)

Organbuilder active in England. Although Swarbrick (Schwarbrook, Schwarbrick) was long believed to be of German origin, recent interpretation of limited evidence points to his coming from Lancashire. Swarbrick settled in London, where he worked for Renatus HARRIS and possibly a DALLAM (Toussaint or Marc-Antoine). During this period he worked on organs for Southwark, St. Saviour's (1703) and Northampton, All Saints (1705). By 1705–06 he was on his own, although his place of residence during the next decade is unknown. Swarbrick built instruments for Bristol, St. Nicholas (1713); Minehead, St. Michael (1713–14); Birmingham, St. Phillip (now a cathedral; 1715; part of case extant); and Shrewsbury, St. Chad (1716; 3/26; dism. 1794). By 1716, he had moved to Warwick, where he built an organ for St. Mary (1717; case extant). He also built instruments for Wells, St. Cuthbert (1718); Birmingham, St. Martin (1720; to Solihull, St. Alphege, ca. 1809; extant); and Stratford-upon-Avon, Holy Trinity (1731, dism. 1841). He added a second manual to an organ at Southwell Minster (attributed to Bernard Smith, 1701; reb. Snetzler, 1765–66; repl. Bishop and Son, 1892).

His organ at Coventry, Holy Trinity (1732, 2/22; dism. 1861) apparently featured three "Dulcimer" accessory stops that struck metal strings; it was difficult to maintain their tuning, and they were removed in 1763. Swarbrick's organ at Coventry, St. Michael's (1733), admired by George Frideric Handel, was considered his masterpiece. Later instruments were built for Oxford, Magdalen College (1737; 3/20; three percussion stops); Salisbury, St. Thomas (1738); Lichfield Cathedral (1740; twenty-five stops); Bristol, Christ Church, 1708 R. Harris organ (reb. 1744; rest. R. Taylor, 1997); and Shepton Mallet (1744). Swarbrick is last mentioned on a contract to repair the Worcester Cathedral organ (1752); his absence on a similar 1754 contract is the basis for a supposition of his death date.

Swarbrick built in the Dallam-Harris style, with its full Cornet and mutations (Tierce, "lesser Tierce" or Nineteenth), a more French quality when compared with Smith. Great and Choir organs were supplied by the same windchest, and borrowing was employed through communication. His legacy seems to have passed to Richard Bridge (who held the 1754 Worcester contract), continuing a stylistic thread through the England family to William HILL.

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SWEDEN

SEE SCANDINAVIA

SWELL

An organ DIVISION that allows for "expression"—namely, a change in dynamic level from soft to loud and back to soft; in more recent instruments, the level of sound can be soft, loud, or shades in between, allowing for crescendo and diminuendo (decrescendo). While increasing or decreasing WIND PRESSURE can change dynamics on woodwind and brass orchestral instruments (as well as FREE REEDS and DIAPHONES), organ FLUE and (striking) REED pipes cannot tolerate an increase (or decrease) in wind without changing pitch and timbre. The swell box is the solution for this problem.

In essence, the swell box is a solid enclosure around the CHEST that contains the affected stops or division. The enclosure has a device on its FACADE or top that, when activated, opens and closes a swell lid or flap, swell shade, or swell shutters (a series of wooden slats). When closed, the sound is at its softest and most distant; when fully open, it is at its loudest and most direct. Where the technology allows it, levels in between can be maintained.

The swell box may have been developed in seventeenth-century Spain. An organ by José de ECHEVARRÍA I at Eibar, San Diego de Alcalá de Henares (1659) possessed a *de ecos* stop (ECHO; Port. *do éco*) box. This consisted of a single stop (usually a reed or Cornet) in a closed box whose hinged lid could be opened or closed by means of a foot lever. This lever had to be held down to keep the lid open. A laterally moving, knee-operated, stirrup-shaped lever (*rodillera*) permitted instantaneous switching from the enclosed stop to its unenclosed state. By the eighteenth century, builders in England and elsewhere had developed the swell shoe, a pedal which, like mechanical KEY ACTION, translated its being depressed into sound using a network of trackers, stickers, and rollers.

In England, Abraham Jordan claimed his swell box in the organ at St. Magnus, London Bridge (1712) was a new invention. Renatus HARRIS presented a proposal for a six-manual organ at London, St. Paul's Cathedral (ca. 1712; never built), in which "the sixth [manual would] be adapted for the emitting of Sounds to express Passion by swelling any Note, as if inspir'd by Human Breath . . . the greatest Improvement an Organ is capable of." Whatever the true chronology or nature of Jordan's "invention" (its description is ambiguous), the swell enclosure he built, which opened a panel in front of the box rather than a lid on top, was new enough that it would have long-lasting impact on the nature of the English organ. As in Spain, this was conceptually part of an Echo division, whether in a box or secondary case, and solo stops were the constituents.

The impulse to enclose an entire division, rather than only solo stops, evolved soon after. In effect, the CHOIR (the old RÜCKPOSITIV, now integrated into the main case) was being changed into an enclosed Echo division. When the novelty of an echo effect had worn off, the idea of an expressive enclosed division became more important interesting to builders; at some point, the term "Swell" was applied to this division. It retained the smaller compass of the Echo, with its emphasis on melody (treble). John SNETZLER discussed a three- or four-stop Swell division in a two-division organ at some length with the elders of the Moravian Community in Fulneck, Yorkshire (1747–48). Mid-century Swell divisions might have two Diapasons, Principal 4', Trumpet, Hautboy, and Cornet III. In a fortuitous discovery typical of much invention, Burkat SHUDI developed the "Venetian swell" (patented 1769), in which dynamic levels for the harpsichord could be varied by "moving louvers" over the strings. This device, an attempt to compete with the fortepiano, did not prove successful there; but it was not long before organbuilders saw the virtue of a swell shade based on movable wooden slats, easily fit into the swell box, easier to maintain, and capable of greater subtlety. Among the first builders to take advantage of this was Samuel Green, who built up the Swell division to include a full chorus of stops and employed horizontal Venetian shutters. He anticipated a later trend by enclosing his largest instrument (Windsor, St. George's Chapel, 1790; 3/25; dism.) entirely in a swell box, as well as some chamber organs. The "Venetian swell" would become universal in England by the next century.

Although strongly associated with English organbuilding at this time, the swell box began to emerge elsewhere in Europe, never more dramatically than in Georg Joseph Vogler's instruments (including the orchestrion) of the 1780s, which were wholly enclosed. That Jorge Bosch Bernati-Verí's turning the Positiv into a Swell division (Madrid, royal chapel, 1778) was considered "notable" suggests that the Eco had only recently gained a more sophisticated role within the Iberian organ. The German-born builder John Geib probably learned of the Swell during a lengthy stay in England and brought it to the United States, where the taste for English-style organs was strong almost everywhere (he worked in New York).

The beginning of the nineteenth century carried over the preferences of the previous one. Scandinavia and the Low Countries retained a generally conservative position, preferring to keep the Rückpositiv in its traditional role in congregational singing. English organbuilders incorporated the Swell division automatically (long before the independent Pedal division was considered essential); indeed, with the Bach revival of the early part of the century, English organists apparently did not believe that Bach had not had an expressive division with which to work. Germany remained somewhat hesitant about the Swell's inclusion, fearing that it would replace familiar divisions such as the Brustwerk, Positiv, or (the by now old-fashioned) Oberwerk. But it gradually replaced one or the other, and by the time of Friedrich Ladegast, Schulze, E. F. Walcker, and other major German builders, the *Schwellwerk* was firmly established, taking over the functions of other, older divisions. Some German builders simply labeled their organs' manuals by number, removing all historical connotations.

The French organ, which had already made its Solo and Echo divisions expressive in the eighteenth century, applied a swell box to its soloistic Récit division, now a full-compass division, in the 1820s. Aristide Cavaillé-Coll, as in so many other areas, was innovative in his application of new technologies. Having learned of the swell box either in Spain while working there or from John Abbey in Paris, he increased its importance to the French organ, gave it even thicker walls and heavier shades to produce even more dramatic effects, and added 16' stops (the "French swell"), but it remained a division subsidiary to the Grand Orgue and Positif. Nonetheless, César Franck and other composers relied on the swell box for effects in their music. English builders—among them Gray and Davison, H. J. Gauntlett, William Hill, and Henry Willis (who borrowed and applied pneumatic technologies to swell boxes, among other organ components)—and American builders pursued similar paths. Increasingly, individual divisions were enclosed—even the Great on occasion; a late-century builder like Hilborne L. Roosevelt might enclose every division except the Pedal, the only division never subjected to "expressivity."

Following the application of pneumatics to swell action, the development of electro-pneumatic motors in the late nineteenth century gave swell shutter actions the same technology as other electro-pneumatic windchest actions, based on wind pressure and an electromagnet, with switches controlled by the swell pedal. Eventually, an all-electric system permitted the direct connection between the swell pedal and a switch that operated the shutters, without any need for wind pressure. Not only could larger organs be winded without fear of pitch problems or "bumps," but Swell divisions could grow to proportions unknown previously; for many builders in the first third of the twentieth century, the Swell became the second most important division after the Great. Whether the builder was George A. Audsley, Robert Hope-Jones, Ernest M. Skinner, or one of their acolytes, and whatever the philosophy was behind the instrument, the Swell was not only considered essential, but had achieved a dual role that allowed it to mimic the Great (for "Baroque" echo effects) or vie with it through tonal contrast. Eventually, the fully electronic organ pioneered by Hammond and eventually given transistor, solid-state, and digital technologies would provide a simple replacement for the Swell: the volume pedal, which used resistance to modulate the dynamic level at will, but without any tonal change (unless programmed in digitally, a complex task).

Meanwhile, in the world of the pipe organ, the ideas of the Organ Reform Movement produced different results. In some situations, the "purist" neobaroque concept meant the elimination of the Swell (indeed, all expressivity) from instruments and a return to the Positiv. In the American classic and other eclectic or neoclassical organ designs, the attempt to make an organ viable for different repertoires usually left a single Swell division, while eliminating all other expression. There was a great deal of debate over issues of "authenticity" versus "practicality," and the Swell, despite its relative "antiquity" (over three centuries), was a flashpoint in the controversy. In the last decades of the twentieth century, however, a neoromantic element in new organ building has restored the swell box to some of its former prominence. While some builders remain beholden to the notion of "re-creating" the past, others are interested in seeing what might come of instruments that, while primarily mechanical in execution, blend elements of the past and present into their designs.

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SWITZERLAND

The alpine country of Switzerland lies in central Europe; its cultural diversity is represented by the four official languages spoken there: German dialects (63.6 percent of the population), French (19.2 percent), Italian (7.6 percent), and Romansh (0.6 percent). Although Switzerland is somewhat isolated due to its mountainous terrain, it has a rich cultural heritage dating from the early Middle Ages. Several important monastic communities produced some of the most important intellectual history of medieval Europe: St. Maurice (established 515 CE), Romainmôtier (fifth century), Disentis (fifth century), and the Benedictine monasteries in Engelberg, Einsiedeln, and St. Gall (the last in 720; all locations mentioned herein are in Switzerland unless otherwise indicated). The traffic routes that crossed through Switzerland brought a flourishing commerce and cultural exchange; the military service of Swiss men in foreign kingdoms brought wealth to leading families and established links to foreign courts and the Vatican. An important Roman Catholic council convened in Basel (1431–47); in 1460, the first Swiss university was founded there. In the late Middle Ages, organ building was cultivated in the Benedictine monasteries in St. Gallen (the most important musical center), Einsiedeln, and Engelberg; outside the monasteries, the organ was accepted more slowly. The earliest record of a specific organ dates from 1303, with the dedication of an organ in Basel Cathedral built by "Meister Raspo" from Frankfurt am Main.

In the fifteenth century, documents become more numerous, demonstrating a competitive spirit among city churches in obtaining instruments. For example, in 1479 a contract for an organ at Zurich, Fraumünster, was issued to a Brother Konrad of the Benedictine Abbey of St. Blasien; it stipulates that the organ should be larger and more perfect than the organ in the city's Grossmünster. The Grossmünster countered with the building of a new organ (1505–7) by Hans Tugi (Tügi) of Basel, who in 1511–12 was hired to expand the organ by adding a Rückpositiv. (He also built organs in Zurich.) The Basel organ was significantly enlarged once more in 1520. By 1500 thirty organs could be identified in Switzerland. During the fifteenth century, organ building was most active along the banks of the Rhine. Hans "von Köln," noted builder in the Netherlandish region, was known as Hans SUISSE, a possible indication of Swiss origins (see Klotz). Jörg EBERT from Ravensburg, Germany (GER), north of Lake Constance, installed organs as far away as the southern Tyrol. Important organ tablatures were put together in the early sixteenth century, by Hans Buchner (Constance and Überlingen, GER), Hans Kotter (Bern), Elias Nicolaus Ammerbach (Basel), and Fridolin Sicher (St. Gall).

The events of the Reformation effectively placed a stranglehold on the employment of music in divine worship. The final blow came from the highly musical Huldrych Zwingli, a composer and player of nine instruments, who placed the doctrine of justification by grace at the center of his Pauline theology. Organs were not attacked and destroyed (the fate of the altars), but were carefully removed and sold. The new Zurich worship service placed humanistic emphasis on the spoken word; singing was forbidden in the church until 1598 when the Zurich Council reinstated it. Instead, sacred music was cultivated in the private music collegia in psalm singing from Strasbourg and Geneva. In Geneva, Jean Calvin did not forbid congregational singing altogether, but banned all instruments from services. In Zurich and its surrounding areas, organs were banned from churches until well into the nineteenth century. In 1809, at the annoyance of the church leaders in Zurich, the city of Winterthur quickly and quietly purchased an organ built by Karl Joseph RIEPP from the former Salem Cloister; Wädenswil followed in 1826. In Zurich, the Neumünster (not yet a part of Zurich proper) bought an organ from the important German-Swiss builder Friedrich HAAS (1840); the Fraumünster acquired an organ in 1853; and the Zwingli Church (Grossmünster) waited until 1876. Other important Swiss cities had preceded Zurich: Basel as early as 1561, Bern in 1726, and Geneva in 1756. The addition of organ accompaniment led to a decline in four-part congregational singing, a Swiss tradition that originated in Geneva, was practiced in the schools, and is continues in rural communities today. The hymnals of the Swiss Reformed Church, including the 1998 edition, are largely printed in four-voice format.

Lucerne and central Switzerland remained Roman Catholic. Until 1848, every canton (or *Ort*, the old term) had its own Confession (ritual). An unbroken organ tradition remained intact in the Catholic churches; an array of impressive seventeenth-century instruments still survive. The history of the central Swiss organ here is lost in the lack of existing instruments. The world's "oldest playable organ," at the Église Notre-Dame-de-Valère, Sion, Valais/Wallis, is an exception; however, only the case and three ranks of high lead content remain from the original instrument (ca. 1435); the remaining work, including the wooden Subbass pipes that tower above the Gothic case, is the work of Christoph Aebi of Solothurn (1689). The Historisches Museum, Basel, has a sixteenth-century house organ formerly owned by the ab Yberg family of Schwyz; the small "Baldachinorgel" from the same period is preserved in the Rhätisches Museum, Chur.

There are a number of seventeenth-century instruments. An anonymous organ (built ca. 1600) with six stops and a pull-down was installed in the church of Sarnen (Obwalden) in 1742; of the original pipes, only the Principal 4' in the facade remains. From the same period is the somewhat larger instrument in St. Josephklösterli, Schwyz, also with six stops, but with a Principal 8' and two Pedal stops, containing considerably more original pipes.

Over the years the Swiss frequently hired foreign organbuilders. The religious and, to a lesser degree, geographical fluidity in Switzerland (especially with Alsace) encouraged this exchange; the Swiss Confederation was not formed until 1815, and this pattern continued into the nineteenth century. Thomas Schott, a native of Ural (Württemberg) and active in Bremgarten, built the main organ in the Kloster Muri (1619–30). With twenty-eight stops and pedal towers in the form of a harp, the instrument once possessed wings that closed over the case; but these were replaced by carved pipe shades when the organ was moved to a newly built Baroque church by Hans Melcher von Zuben (1696/97; reb. V. F. Bossard, 1744). The Schott and two choir organs were restored by the METZLER Orgelbau (1966–71); the smaller Gospel organ (1/8) was built by Jodokus Schnyder (1660), the larger Epistle organ (1/16) by Melcher von Zuben (1697). Schott also built for Beromünster, Bremgarten, the Franziskanerkirche in Lucerne, and Rapperswil, all of which are lost. The Kloster Muri also owned a priceless, well-preserved regal (1644), built by Christophorus Pfleger; this instrument, now located in the Richard-Wagner-Museum, Tribschen (near Lucerne), is noteworthy for its right-angled lead resonators and original reeds. Pfleger, a native of Thann (Upper Alsace), built a house organ (1639) with transposing capability; it was moved to the Staatliche Sammlung alter Musikinstrumente, Berlin, where it was destroyed during World War II. Hans (Johann) Geissler of Salzburg built a new organ for the Hofkirche St. Leodegar, Lucerne (1640–51; reb. Haas, 1860). Niklaus Schönenbühl, from the village of Alpnach, Vierwaldstättersee, built the choir organ in Stans (1646; 1/8/no pedal; rest.) and eventually built the choir organ in the Franziskanerkirche, Lucerne (1646–51; 1/7).

While in French-speaking Switzerland and in the Basel region French influences dominated, notably with rich mutations and reeds, the Italian-speaking sector was influenced by Lombard elements. In 1588, the collegiate church in Bellinzona received an organ built by the Brescian builder Graziadio ANTEGNATI (1/11; reb. C. Bossi, 1810–16, Organo Eco added; rest. Mascioni, 1997–98; now 2/44, divided stops). The church of the Madonna del Sasso, Morcote contains an organ from the beginning of the seventeenth century, later expanded in the eighteenth century. Italian-influenced organs had spring-chests; in addition to the typical Italian ripieno of individual Principale stops, they often only had a 4' flute and a type of Voce Umana (later called the Suavial).

Prior to 1700, Swiss organ building had strongly reflected south German traits; during the eighteenth century the BOSSARD family, from Baar on the Zugersee, brought foreign influences from Italy and France into play. In addition to the aforementioned Italian elements, the French influence brought greater use of Tierce stops. The firm's founder, Josef Bossard, built a large and richly equipped organ for the new Baroque church at the Cistercian monastery of St. Urban (1716–21; 3/40). Despite the cessation of religious activity at St. Urban (1848), the instrument was preserved virtually intact. In 1943 the KUHN firm undertook a careful restoration, although the subsemitonic split keys (E-flat/D-sharp) were removed; a later restoration by the same firm (1992–93) restored historical elements such as the split keys to the organ. His son Victor Ferdinand Bossard rebuilt the Schott/Melcher von Zuben organ at Kloster Muri (1744). Karl Joseph Maria Bossard, Josef's grandson, built a processional (portative) organ for Muri, now located in the Zurich Landesmuseum.

The organ at the former Benedictine monastery in Rheinau (1711–15; 3/36) was built by Augsburg, Germany, native Johann Christoph Leu, brother of Leonhard Leu of Bremgarten, who built the organ in the Bern Münster (1726–30; 3/38). Haas undertook a careful rebuild of the Rheinau instrument (1840–41); a 1941 "restoration" did more harm than good, but Kuhn restored the organ to its former condition (1988–90). These two large organs, typical of seventeenth-century instruments, have richly varied tone colors and lack 16' manual stops. Another surviving instrument, the choir organ in Rheinau (1709–10) was housed in a case in the shape of a sarcophagus by Johann Christoph Albrecht of Waldshut, Germany. In 1746 Johann Conrad SPEISSEGGER enlarged the instrument from six to ten manual stops and added two new pedal stops. The unusual shape of the organ honors the grave of St. Fintan, an Irish monk who brought Christianity to Switzerland. Other later Baroque and early Romantic builders include Anton and Felix Carlen of Reckingen (Valais/Wallis); Sylvester Walpen, from the same canton, who settled in and built a choir organ for Lucerne, Hofkirche St. Leodegar (1842; 2/27; rest. Kuhn, 2003); and Aloys Mooser (1770–1839), working in French-speaking Switzerland, who built the famous main organ of Fribourg, St. Nicolas Cathedral (1834; 4/61; rest. Neidhardt and Lhôte, 1982). Franz Anton Kiene from Langenargen, who created a whole series of organs in central and eastern Switzerland; the best preserved resides in the Stiftskirche Beromünster (1840–42, 2/28), with its only remaining original solid walnut console: a work of superlative craftsmanship, heavy playing action (also true of his St. Gallen Cathedral organ, due to a 10-meter linkage between the two choir organs beneath the floor), and majestic sounds with varied foundations and low-pitched mixtures and mutations (still impressive).

Unfortunately, no instrument by the most important Swiss organbuilder of the nineteenth century, Friedrich Haas, has survived without alteration. The organ he built for Thalwil, Reformed Church (1865) underwent many changes, but in 1992 was transferred to its original position and carefully reconstructed so that it again reveals the unmistakable charm of a small Romantic masterpiece. Little of Haas's most significant instrument, the rebuilt Geissler organ at Lucerne, Hofkirche St. Leodegar (1860), lavishly praised by ARISTIDE Cavaillé-Coll, remains since the Kuhn renovation (1972–77).

Haas's successor in 1868 was Friedrich Goll (1839–1911), whose family continued operation of the firm until the 1970s. His early organs with mechanical cone-chests as well as those built after 1894 with pneumatic chests are still valued. An especially well-preserved, technically sound instrument may be heard at St. Heinrich zu Beckenried on the Vierwaldstättersee (1913; 2/29), built by his sons Karl Goll (1876–1967) and Paul Goll (1880–1955). The largest organ in Switzerland, also built by Goll Orgelbau, stands in the Engelberg monastery (1924–26; 4/135; pneum.; replaced 1875 Goll instrument; rest. Graf, 1992–93; electric). Tonally and technically, the organ has remained untouched, with only two Pedal Mixtures added.

Since Switzerland was spared from World War I, the organ reforms initiated in the Alsace took hold and almost imperceptibly moved the country into the ORGAN REFORM MOVEMENT. That meant the incorporation of slider-chests, as in the rebuild of the Leonhard Leu organ at Bern Münster (Kuhn, 1930; 4/76), with the addition of a Rückpositiv, successively fewer foundations, and French reeds and mild mutations. But a Swell division remained indispensable, and electro-pneumatic or electric action remained the norm until after the mid-twentieth century. These instruments no longer reflect current thinking; "Baroque" specifications without string stops (except the occasional Gemshorn), but voiced rather sharply, are too recent to be placed under historical protection and are therefore at risk. There should be discussion concerning the qualities of such organs so that significant "period instruments" of that, or any historical period, do not disappear.

There are a number of Organ Reform instruments having mechanical action without the use of BARKER LEVERS or electric couplers such as in Zurich, Grossmünster (Metzler, 1960; 4/64); Geneva, Cathédrale St.-Pierre (Metzler, 1965; 4/67); Zurich, Prediger Kirche (Kuhn, 1970; 3/46); Lucerne, Matthäuskirche (Neidhart und Lhôte, 1972; 3/39); Hitzkirch (Armin Hauser, 1985; 3/39); Stans (Matthis, 1987; 3/37); Kriens, near Lucerne (Kurt Lifart, 1987; 2/31); and Biel/Bienne, Temple du Pasquart (Hans Füglister, 2001; 4/43). Most of these are equipped with Swell divisions; the bellows are sufficient to wind the mechanical action. Flexible winding and unequal temperaments are hallmarks of these reform instruments, also apparent in casework and facade designs.

A plurality of styles is the order of the day. When multiple organs cannot be placed in a single room (possible in Einsiedeln with its unique and sound-enhancing Baroque architecture), one must choose. Goll Orgelbau was justified in building a seventeenth century–style organ into the 1653 Manderscheidt case at Lucerne, Franziskanerkirche (1988, 3/33), although historically appropriate meantone temperament and short octave keyboards were lacking. Goll has likewise built instruments based on the French Romantic aesthetic; its Ruswil organ (1993; 3/47) has a *jeux de combinaison* using a combination of mechanical stop-knob action and foot lever. The early death of Jakob Schmidt of Goll robbed Switzerland of one of its leading case designers; his legacy stands in the new Lucerne Concert Hall (2000; 4/66). Though the French Romantic school has always been valued in Swiss organ building and playing, a renewed interest in the German Romantic is influencing new organ building, as may be seen in Wädenswil (Hans Späth, 2001; 3/41).

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T

TABLATURE

A notational system, employing letters (German tablature) or numbers (Spanish tablature), once used as an alternative to conventional staff notation by keyboardists and keyboard composers in German and Spanish regions of Europe. (A less common Italian system will not be discussed here.) A musical manuscript or publication written with this notation was also called a tablature.

Documented sources of keyboard tablature notation date from as early as the fourteenth century, and development of these systems seems to accompany the developing independence of instrumental music from vocal music in the fifteenth and sixteenth centuries. By the second half of the eighteenth century keyboard tablatures were largely extinct, replaced by the system of staff notation, which was convenient for notating ensemble music of any kind in score. Although tablature has long been obsolete for performance purposes (except for guitar transcriptions used in popular music), an understanding is essential for scholars and performers who study the original sources of this music.

General

Tablature is an instrumental musical notation that grew from the unique processes of pitch production on individual instruments. Tablatures vary according to instrument type and manner of sound production; most systems encode, as an inherent part of the notation, information useful for the production of specific pitches on a specific instrument. Thus, lute or viol tablatures would inform the performer which string to play and at which fret it should be stopped; woodwind tablatures tell which holes to cover; and keyboard tablatures indicate which keys to depress.

Unlike staff notation, which combines pitch and rhythmic indications into a single symbol, tablatures generally juxtapose two separate symbols, one for pitch and one for duration. To scholars, tablature notations seem needlessly complex and complicate their attempts at study and analysis; but to performers of the intended instrument, these more complex notations may have actually been, from a practical standpoint, the simplest.

Keyboard Tablatures

Originally, keyboard tablatures must have suggested a practical link to the keys of the instrument. Indeed, the anonymous tenth-century Bern organ treatise, *De fistulis Organis*, describes the presence of pitch names, for the performer's visual reference, written directly on the keys of the organ. If letters of the alphabet could be used in this way, it is just as conceivable that numbers could have been used in a similar manner. Thus, the origin of "German" keyboard tablatures may be associated with the practice of lettered keys, and the origin of "Spanish" tablatures may, at least hypothetically, be associated with numbered keys.

In the case of keyboard tablatures, this practical connection to the instrument dissolved fairly early in the notation's history. There is no evidence that this lettering or numbering of keys survived beyond the Middle Ages, but performers found themselves reluctant to abandon a system which had become familiar and comfortable. For almost all surviving music in keyboard tablature, there were few practical reasons why it could not have been recorded in staff notation. But despite this divorce from their original link with performance, keyboard tablatures did prove to have several selling points: they were economical of space; they were simple to write and economical to print (compared to staff notation, which did not become practical until the sixteenth century); they were easy for beginners to learn (the pedagogical complexities of staff notation come early in the process, the difficulties with tablature come later); they were often capable of indicating practical information such as when to use which hand; they were useful for notating polyphonic music (having more than one melodic or bass line) to be played by a single instrument in score; and they were by necessity less ambiguous than staff notation in their notation of accidentals and musica ficta.

German Keyboard Tablature

There were two basic types of German tablature, described commonly as "old" and "new." The basic distinction is the "new" tablature's use of letters in all voices, while "old" tablature used staff notation for the upper (treble) voice. In reality, German tablatures show great variety within these two categories, as individual musicians modified the notation to fit their specific needs.

All German keyboard tablatures share certain common features. The basic characteristic is the predominant use of letters with some indication to place the pitch in its correct octave. The octave immediately below c' ("middle C") is generally represented by lowercase letters. The lower octave uses uppercase letters or, alternatively, underlined lowercase letters. The first octave from c' and above uses lowercase letters with a horizontal line or dash above each. The upper (or "second") octave follows this pattern but uses double dashes, a saw-toothed line, or even doubled letters. Among tablature authors, there is no general agreement on the point where octaves shift: octave division does not necessarily occur between B and C, but can also be found between A and B♭ or between E and F. Letters are often aligned in rows to approximate the concept of voice-leading, but consistency is also lacking in this procedure; some authors group voices according to the way the hands would "grasp" the notes. Rhythmic symbols (derived from rhythmic indications used in medieval mensural notation) are placed above the letters. Unlike the practice in some instrumental notations, such as lute tablature or Spanish keyboard tablatures, each row of letters usually has its own row of rhythmic signs. German tablatures are unbarred, but the spatial grouping of rhythms usually suggests measurelike units.

German tablature utilizes only twelve different letter symbols to represent common pitches. Perhaps because these symbols referred originally to letter-names on the keys, and each key had but one name, enharmonic distinctions are not made, depite the clear distinctions inherent in the temperament systems then in use. White keys are named A-H-C-D-E-F-G; the use of H arose from modal theory of the medieval period, which put modern B-   into the standard scale (labeled as "B"). Black keys are named Cis (C♯/D♭), Dis (D♮/E♭), Fis (F♯/G♭), Gis (G♯/A♭), and B (B♭/A♯). In case of the black keys (except B), "is" is a Latin-derived genitive (possessive) word-ending; thus, Cis (C-♯/D♭) "belongs to" C. The Latin abbreviation for "is" (a downward loop or tail) was adopted and applied to the corresponding white-note letters to notate such pitches; for example, the symbol for Cis was produced by appending the "is" loop to the letter C.

"Old" German tablature, fully developed by the mid-fifteenth century and in use through the mid-sixteenth century, is actually a mixed notation. Its lower voices are notated in letters, but the top voice is notated mensurally on a staff of six, seven, or eight lines. This combination of two notational styles into one seems to have had practical applications: the mensural notation for the upper voice was far better adapted to show the busy rhythmic activity typical in the treble-dominated music of the time, while the use of letter notation was reserved for the slower moving lower voices. This notation also captured the realities of hand division: the performer's right hand performed the active upper voice (in mensural notation) while the left hand "grasped" (played) all the lower voices together (in letter notation).

"New" German tablature, in use from the mid-sixteenth century and legitimized in 1571 by Elias Nicolaus Ammerbach's landmark publication *Orgel oder Instrument Tablature*, abandons the use of staff notation for the upper voice and presents the entire texture in letter notation. This development recognizes the domination of imitative polyphony (the Renaissance predecessor of the Baroque fugue) in sixteenth-century music, with its corresponding rhythmic similarity of rhythm among all parts. It also demonstrates the high status of letter notation among keyboardists; it was, after all, the staff of the "old" notation that was replaced, not the letters. Samuel Scheidt's *Tabulatura nova* (Hamburg, 1624) was the first publication to replace letter notation entirely with separate staves of staff notation (*partitura*); it did not meet with widespread approval.

Spanish Keyboard Tablatures

This system used numbers instead of letters to represent pitches, leading to the hypothesis that Spanish instruments used keyboards with numbers (perhaps for teaching purposes, perhaps regularly). Thus, as one form of Spanish tablature shows, the keys in an octave would be represented by the numerals 1 through 7 instead of the German use of letters A through G. Again, as with German tablatures, there are several variations on this principle; different Spanish tablatures show different approaches within the same general concept.

Because the earliest extant Spanish keyboard music is of a relatively late date (earlier Spanish keyboard musicians may have employed Italian staff notation, just as some southern Italian composers would later borrow Spanish notation), the history of Spanish tablature does not begin until the mid-sixteenth century, well after German tablature had fully matured. Spanish tablature is, however, a printed tradition (predating the earliest printed German tablature by sixteen years), and its peculiar characteristics may be linked to practical typographical considerations in the print shop, rather than to the musical needs of the performer.

The tablature notation used in the first Spanish keyboard print, Juan Bermudo's *Declaración de instrumentos musicales* (1555), is a cumbersome system. Each key in the keyboard's forty-two-note compass (CDEFGA-a'') is represented by a number from 1 (C) to 42 (a''). These numbers are printed on a stafflike set of horizontal lines (between two and six in number) that represented contrapuntal voices or parts in the texture; thus, four lines with numbers would represent a four-voice composition. Although Bermudo's system accurately notates pitch and voice-leading (progression of notes within one voice), it fails to acknowledge the music's rhythmic components. The music is barred regularly, and ties are sometimes used in the upper voice, but individual signs for rhythmic note-values are absent.

In the same volume, Bermudo presents an alternative method which improves on the first in several significant ways, most notably in its simplification of the pitch-numbering system. Instead of assigning a number to every key, only the "white" notes are numbered here. Each "black" note shares the number of the white note to its lower left. A sharp sign (in this case, an *x*) above the number identifies the "black" note and distinguishes it from its "white" counterpart. Another difference between Bermudo's two systems is the second's abandonment of the horizontal lines or "staff" (showing contrapuntal motion) on which the numbers in the first system had been written. The single remaining horizontal line is now placed between rows of numbers to show the division of the texture into left- and right-hand regions. A final improvement in Bermudo's second system is the addition of rhythmic signs above the upper voice. These rhythms, as in Spanish and Italian lute tablatures, notate only the shortest note-value in use at a given moment. This rhythm remains in effect until replaced by another sign; in other words, in a string of equal rhythms only one rhythmic sign is needed. Although some rhythmic ambiguity still remains (especially in the duration of slower moving notes), this system is generally sufficient for the music it notates.

Bermudo's two notational systems ignore the fact that most instrumentalists think not in terms of a musical continuum from the bottom to the top of an instrument's compass (or range), but of a continuum conveniently subdivided into distinct octaves (or registers). A third form of Spanish keyboard tablature acknowledges this practical distinction. This system, first seen in the *Libro e cifra nueva para tecla harpa y vihuela* by Venegas de Henestrosa (1557), uses the numerals 1–7 to represent the "white" notes in the "middle octave" f–e'. One or two dashes through a number indicate a pitch one or two octaves, respectively, below the middle octave; likewise a dot or comma superscription indicates a pitch one or two octaves, respectively, above the middle octave. As in Bermudo's first system, the numbers in this notation are printed on horizontal lines which represent individual voices in the contrapuntal texture. "Black" notes in this system are notated by adding a sharp or flat after the affected number (modern staff notation places these signs in front of the affected note). As in German tablatures, Henestrosa deals with the pitch B differently; here, the use of a flat or natural sign in a "key signature" (a unique occurrence of this concept in tablature notations) stipulates B♭ or B♮ through the work. Rhythms, shown above the tablature, follow the principles in Bermudo's second system. However, some rhythmic refinements have been added and are located, not with the rhythmic signs above the tablature, but with the pitch indications in the tablature proper. A rest, for example, could be indicated in any voice with an oblique line (/) or the letter *p;* tied rhythms could be shown by a comma placed where the second part of the tied unit would logically appear.

CLEVELAND JOHNSON

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TAFALL Y MIGUEL, MARIANO (1817–1874)

Spanish author, organbuilder, organist, and composer. Born in Lérida on 27 September 1817, Tafall became an instrumentalist at the Burgos cathedral at age twenty. In 1854 he was named master organbuilder and musician for the cathedral at Santiago de Compostela, where he remained until his death on 26 September 1874. He built organs in northern Spain, above all in Galicia. Large instruments by him, in uncompromising Spanish Baroque style, stand in the cathedrals of Mondoñedo (1864, two organs) and Lugo (before 1870).

Tafall y Miguel is remembered principally for his magisterial *Arte completo del constructor de órganos, o sea, Guía manual del organero*, published in four volumes between 1872 and 1876. Illustrated with woodcuts, and amplified with tables of scales for all types of pipes and instructions for making the hand-tools used by organbuilders for centuries, the *Arte completo*’s clear organization, focused prose, and attention to practical detail elucidate every aspect of the organbuilder’s art. Tafall y Miguel’s work ranks among the most comprehensive and practical treatises on historical organ construction.

The book’s full significance cannot be appreciated without considering the unique development and diffusion of the Iberian organ. Its distinguishing characteristics, consolidated by 1730, remained stable until the 1880s. The Spanish organ Tafall y Miguel describes in the 1870s is resolutely Baroque, virtually untouched by the European Romantic developments of the late eighteenth and nineteenth centuries. Organs in this style were not confined to Spain and Portugal; hundreds are now being found in old churches across Latin America. These instruments, built locally between the seventeenth century and the first decades of the twentieth century, are often in original though badly deteriorated condition. The *Arte completo* provides exhaustive detail about an exceptionally widely diffused and important Baroque organ style, of which there survives an unknown but very large number of still incompletely documented and poorly understood examples. In the light of all this, the importance of Tafall y Miguel’s book for modern-day researchers, restorers, and organists can hardly be overestimated.

James Wyly

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TAMBURINI

Italian firm of organbuilders. Initially an accordion maker, Giovanni Tamburini (b. Bagnacavallo, Ravenna, 25 June 1857; d. Crema, 23 Nov 1942), turned to the organ-building trade at age thirty under the tutelage of Pietro Anelli of Codogno (Milan). In 1887 he joined the Pacifico Inzoli of Crema and soon after invented a double-compartment windchest and a chorus stop using an electric action. In 1893 he opened his own business in Crema, where he constructed organs with electric action. The firm was later headed by his sons Umberto Anselmi (Sellero, S. Maria Assunta, 1914; 1/13, tub./pneum.) and Severgnini Luigi; and then his two grandsons, Franco Anselmi Tamburini and Luciano Anselmi Tamburini (São Paulo, Theatro Municipal, 1967–69; 4/78). In 1979, they divided the company into two independent businesses, Tamburini in Crema (led by Franco) and Anselmi-Tamburini in Pianengo (headed by Luciano). Claudio Anselmi Tamburini now runs a workshop in Asciano (Siena).

Tamburini’s first organ was built for Treviso, Nogarè di Cornuda (1894). Several important organs followed, including the electro-pneumatic action organs built for Florence, S. Croce (1931), Milan Cathedral (1938; collab. Mascioni), and the Vatican, St. Peter’s. The firm discontinued electro-pneumatic action in 1967, turning to tracker action for their organs at Bologna, S. Maria dei Servi (1965), Rome, S. Maria della Mercede (1971), and Florence, S. Miniato al Monte (1979).

Tamburini took interest in the restoration of keyboard instruments, including the harpsichords of Vito Trasuntino (1571) and Pascal Taskin (1779) now preserved at Milan, Civic Museum. Organ restorations include the two well-known organs of Bologna, S. Petronio (Lorenzo da Prato, 1475; Baldassarre Malamini, 1596); Parma, Colorno, Palazzo Ducale, S.

Liborio (1792–96 Serassi organ; 1985); and the three-manual organ at Colonna, Bergamo, "San Alessandro" (Serassi, 1781–82).

THOMAS CIMARUSTI

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TAMITIUS

German family of organbuilders, active in Saxony. Andreas Tamitius (b. Döhlen, near Dresden, 13 Aug 1633; d. Dresden, 1700), the son of a pastor, received his training in the Netherlands and was appointed organbuilder to the Saxon electoral court in 1665. Though no complete organs of his survive, the surviving specifications indicate strong Dutch influences. His works include: Dresden, Kreuzkirche (1666–68); Burkhardswalde near Meissen, Dorfkirche (1671, installed organ from Nossen); Dresden, Frauenkirche (1671, 1681); Dresden, Schlosskapelle (rest. 1675); Bischofswerda, Stadtkirche (2/17; 1688–90); Dresden-Leubnitz, Dorfkirche (1679–80, reb.); Görlitz, Stadtkirche (1681–88; 2/30; reb.); Dresden, Sophienkirche (rest. 1681, 1693, 1695); Freiberg, Petrikirche (rest. 1690); Freiberg, Cathedral (rest. 1690); Freiberg, Nikolaikirche (1692; reb.); Freiberg, Jakobikirche (1695; reb.); and Torgau, Stadtkirche (ca. 1695).

Johann Gottlieb Tamitius (b. Dresden, 9 Feb 1691; d. Zittau, 26 March 1769), son of Andreas Tamitius, apprenticed with Johann Georg Fincke of Saalfeld. He set up his first workshop in Strahwalde near Herrnhut, then moved to Zittau (ca. 1717–20). He built approximately forty organs, primarily around Zittau; of particular importance were his instruments at Lossow near Frankfurt an der Oder (1744); Waltersdorf near Zittau (1765–66; 2/18; extant); and Reichenau near Zittau. His organs have typically eighteenth-century central German specifications while including newer stops such as Flaute Douce 4', Flute á Traverse 4', and Viola da Gamba 8'. His son-in-law Leonhard Balthasar Schmahl (1729–79) worked in his shop from 1758; his son Johann Gottlob Tamitius (b. Zittau, 15 Jan 1738) also worked in the shop as a builder, and helped with the Waltersdorf organ in 1765–66.

DOUGLAS E. BUSH

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TANNENBERG, DAVID (1728–1804)

German-born American organbuilder. Tannenberg was born on 21 March 1728 in Berthelsdorf, Saxony, where his parents, members of the Bohemian Brethren, had fled for religious reasons from Moravia. Tannenberg became a follower of Count Nikolaus Zinzendorf, the spiritual leader who reorganized the Brethren as the Moravian Brethren. Zinzendorf encouraged him to leave Germany; he went first to the Netherlands, then to the American colonies, arriving in 1749. Tannenberg first worked as a joiner in Bethlehem, Pennsylvania, where he met Johann Gottlob KLEMM, who moved there in 1756. Until his death (1762), Klemm introduced Tannenberg to the craft of organ building; thereafter, Tannenberg obtained permission of the Moravian village authorities to continue in the trade. He completed his knowledge by studying a copy of Georg Andreas SORGE's treatise *Die geheim gehaltene Kunst der Mensuration der Orgelpfeiffen* (*The Secretly Kept Art of Scaling Pipes*, 1760), which Sorge sent to his "Pennsylvanian brothers" in 1764. Tannenberg's first organ was built was for the Moravian chapel in

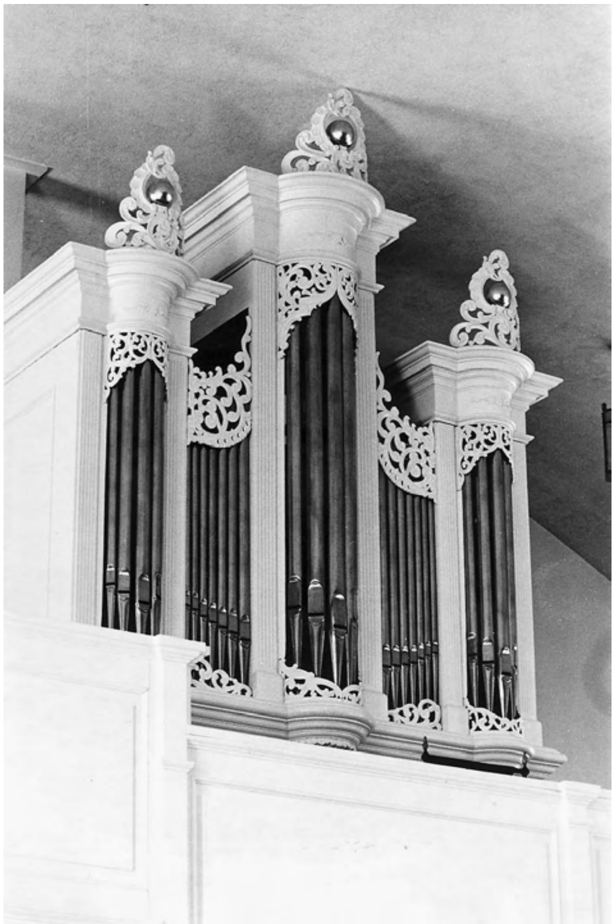

Fig. 73. Tannenberg organ, 1787 (1/9; rest. McFarland, 1983), Single Brothers' House, Lititz Moravian Congregation, Lititz, Pennsylvania (Photo by William Van Pelt).

Lancaster, Pennsylvania (1765; lost). Over the next four decades, Tannenberg completed forty-two organs and most likely built other keyboard instruments such as clavichords.

Tannenberg's organs emerged out of the organ-building heritage of central Germany. His organs for Lutheran and Reformed churches copied contemporary German models; his instruments for Moravian congregations used no mixtures or reeds, but a unusual variety of stops for accompaniment were incorporated. Tannenberg's largest organ was built for Philadelphia, Zion Lutheran (1790; 3/33); U. S. President George Washington attended the dedication recital of this organ, the largest in the country at the time. The organ was later a victim of fire (1794). Surviving Tannenberg organs can be found at Moselem, Pennsylvania, Zion Lutheran (1770; 1/6/no pedal; rest.); Lititz, Pennsylvania, Moravian Church (1787; 1/9/no pedal; dism.), Old Salem, North Carolina, Single Brethren'sHouse Moravian Church (1798; 1/5/no pedal; formerly Salem, North Carolina, Moravian Chapel); and Madison, Virginia, Hebron Evangelical Lutheran (1802; 1/8). In his last years, he was assisted by his eventual successor, Johann Philipp Bachmann (1762–1837). While voicing his last organ (York, PA, Christ Lutheran; 1/11; extant), he suffered a stroke, dying a few days later on 19 May 1804.

The most productive and professional organbuilder in North America before 1800, Tannenberg's influence was limited by his exclusive connection to German-speaking communities and his vow to Moravian faith and lifestyle. (Moravian community rules would not have allowed him to enlarge the business.) Nevertheless, Tannenberg is said to have been the first full-time organbuilder in North America, and the best of his era.

MARTIN KARES

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TAWS, CHARLES (1763–1836)

Scottish-born American organbuilder; also spelled Tawse or Tawes. Born in Aberdeen, Taws seems to have emigrated to America in 1786; about two years later, he was living in Philadelphia. Although he placed occasional advertisements about his organ-building activities in Philadelphia newspapers, little is actually known about his work. He erected a three-manual instrument around 1801 in the city's St. Augustine's Church and a small instrument at Burlington, New Jersey, St. Mary's Episcopal, at about the same time. Significantly, Taws was building large organs at a relatively early stage of U.S. organ-building history. He also rented an organ to Philadelphia's Zion Lutheran Church after a fire severely damaged the church's David TANNENBERG instrument (1790); it was removed in 1804, and eventually replaced by a John LOWE organ (1811). Taws was assisted by two sons, Joseph and Lewis Taws, and was also involved in music publishing and piano manufacture. He died in Philadelphia on 1 April 1836.

STEPHEN L. PINEL

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TAYLOR AND BOODY

American organ-building firm. The partners, George Taylor and John Boody, originally worked with John BROMBAUGH. Taylor, who trained with Rudolf von BECKERATH and was Brombaugh's partner in Ohio (1970–77), established a new firm with Boody in Staunton, Virginia (1979), after Brombaugh had relocated to Oregon.

After a thorough study, Taylor and Boody has based its tracker organs on eighteenth-century Dutch and north German designs; these instruments have followed their models in disposition designs, while the Renaissance-style cases feature wood's elegant simplicity with "leafy" pipe shades. Among its larger instruments are: Worcester, Massachusetts, College of the Holy Cross (1985; 4/53); Indianapolis, Christ Cathedral, 1992 (3/38); Yokohama, Japan, Ferris Jogakuin Women's College (1989; 3/45); and Naples, Florida, Moorings Park, Bower Chapel (2001; 3/32). Taylor and Boody specializes in two- and one-manual instruments, including Coshocton, Ohio, Presbyterian Church (1979; 2/20; its first organ); New York, St. Thomas Episcopal (1996; 2/25); and Lynchburg, Virginia, Holy Trinity Lutheran (1990; 2/29). The firm has also restored instruments of American or English origin, among them

Williamsburg, Virginia, Governor's Palace (eighteenth-century. English chamber organ, 1981; 1/3); Lexington, Virginia, Washington and Lee University (1872 Erben organ, 1998; 1/7); and Winston-Salem, North Carolina, Old Salem Moravian Community (1800 Tannenberg organ, 2003; 2/13).

RICHARD KASSEL

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TELLERS

American organ-building firm. Hermann Josef Tellers (b. 13 June 1839; d. ca. 1903) and his sons Henry (Heinrich Josef) Tellers (b. 17 Feb 1875; d. 9 Aug 1920) and Ignatius A. (Ignaz) Tellers (b. 30 Mar 1876) came from Langbroich, Rhineland, in 1881 to New Orleans. They worked for William SCHUELKE in Milwaukee, Wisconsin (1888–92), then for A. B. Felgemaker Company in Erie, Pennsylvania. After Felgemaker's death, the Tellers brothers, in partnership with William A. Sommerhof, another Felgemaker employee, founded the Tellers Organ Company (1906); it was renamed the Tellers-Sommerhof Organ Company in 1911. Among their organs is New Orleans, Holy Trinity Catholic (1912; 3/31; dism.).

In 1918 the Felgemaker firm was purchased by the Tellers Company, and Albert E. Kent, another Felgemaker employee, purchased Sommerhof's interest in the firm, which now became the Tellers-Kent Organ Company. The firm declared bankruptcy in 1933. In 1945, Herman J. Tellers, son of Henry, revived the business as the Tellers Organ Company, Inc. Among this firm's organs is Milwaukee, Cathedral of All Saints (1967; 2/26). The firm had built some eleven hundred organs by the time the factory was purchased in 1980 by the Organ Supply Corporation. Now under the leadership of Henry Tellers, the firm (which remains in Erie) represents Rodgers Classic Church Organs, among others.

ELIZABETH TOWNE SCHMITT

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TEMPERAMENT

SEE TUNING AND TEMPERAMENT

TERLETZKI

Prussian organ-building firm active in the latter nineteenth century. August Terletzki (1829–ca. 1895) and Maximilian (Max) Terletzki (1834–1903), the latter a student of Aristide CAVAILLÉ-COLL, lived and worked in a region that, until 1772, had been part of Poland. The firm, known as Terletzi Gebrüder, had its workshop in Elbing (now Elblag, Poland; all present locations in Poland unless indicated). In 1857, Max left the Elbing workshop and began his own in Königsberg (Kaliningrad, Russia). Organs are credited to the partnership, the brothers individually, or simply "Terletzki."

Originally, Terletzki instruments were built with mechanical action and slider-chests; gradually, they shifted to cone-chests, and added Barker levers to larger instruments. Among the firm's new instruments were: Glottau (Glotów), Holy Savior (1865; 2/29; extant); Allenstein (Olsztyn), St. Jakobi (ca. 1865; 2/16; extant); Dörbeck (Próchnik) (1874); Elbing, Heilige Drei Könige (ca. 1880); Tiegenort (Tujsk), positive (ca. 1890; 2/18/no ped; destr. 1945; Sczuplienen (Sczupliny), positive (1890); Falkenberg (Niemodlin) (1895; destr. World War II); Willkischken (Vilkyškiai, Lithuania) (1898; destr. 1944); and Thorn (Torún), St. John (1898).

The Terletzkis were even more active in repair work and "restoration," the latter usually denoting a rebuild and, in later years, a change to pneumatic action. Among these instruments were: Frauenberg (Frombork), Cathedral of the Assumption and S. Andrew (1685 D. Nitrowski organ; 1857, 1870; reb. E. Kemper, 1935; destr. 1945); Elbing, St. Marien, 1643 J. Werner organ; 2/31; 1865; 3/40; destr. 1945); Peplin (Pelplin), Cistercian Church of the Assumption (now Cathedral) (1680 J. G. Wulf organ; 1870; reb. B. Göbel, 1907); Hirschfeld (Saxony) (1725 A. Hildebrandt positive; 1852; 1/15; reconstr. 1871; lost); Thorn, St. Marien (1609 J. Hellwig organ; 1879; 1/20; extant); Marienburg (Malbork), St. George (1712 J. Wendt organ; 1879; 3/30; extant); Tilsit (Sovetsk, Kaliningrad), Deutsche Kirche (1793 J. Preuss organ; 1880; thirty-one stops); Hohenstein (Olsztynek) (1764 C. H. Obuch organ; 1883; 2/20, mech.; reb. Wittek, 1916; pneum.); Königsberg, Cathedral (1721 J. J. Mosengel organ; 1888; destr. 1944); Fischhausen (Primorsk, Russia)

(1616 A. Zickermann II organ; 1889; 2/26); Danzig (Gdansk), St. Peter and Paul (1769 J. F. Rhode organ; 2/40; 1890; 3/44, pneum.; destr. 1945); and Königsberg, Schlosskirche (1732 G. S. Caspari organ; 1893; reb. Furtwängler and Hammer, 1934; destr. 1944).

The Teletzki partnership built several new organs, often in cases dating from the eighteenth century and earlier. Given the lack of concern for conservation in the late-nineteenth-century European aesthetics of the builder, designer, or client, it is not surprising that they and their contemporaries removed and discarded original elements as a matter of course; modernity was prized above all. Instruments such as those by the Terletzkis put an end to most Polish Baroque organs; only the cases with old facade pipes were saved, mostly under the protection of law.

August's Elbing shop was taken over by Eduard Wittek (b. 1857; d. Elbing, 1927), a former apprentice, in 1893. Wittek, who developed a pneumatic boxchest, was succeeded by his son Gerhard Wittek from 1927 until the firm's closure in 1944. Some Wittek organs in former West Prussia (Pomorze Gdanskie) are still in playing condition. Max's Königsberg shop went to Bruno Göbel (b. Landsberg [Gorzow ′ laski], 6 Oct 1860; d. 1945) in 1903. In the southern part of former East Prussia (now Poland), a number of Göbel organs of great tonal interest remain, including those built by Bruno's sons Alfons Göbel and Friedrich Göbel before the firm closed in 1944. Another son, Josef Göbel, founded his own workshop in Danzig in 1920; he built mostly electro-pneumatic organs until 1944.

As with other builders who worked in Prussia and Silesia, most Terletzki organs were destroyed during World War II or during the Russian occupation (and German evacuation) thereafter. In Poland's postcommunist era, surviving churches have returned to their original function, and conservation efforts are being directed at the surviving instruments of the Terletzkis and other Romantic and post-Romantic builders.

Richard Kassel
Jan Janca

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TERTIAN/TERZIAN

A compound stop properly consisting of two foundation ranks pitched at an interval of a minor third (hence the name), usually 1-3/5' + 1-1/3', to reinforce the 8' harmonic series. In the pedal, they may be at 3-1/5' + 2-2/3' to reinforce the 16' harmonic series. A third rank is sometimes added: 2' + 1-3/5' + 1-1/3', or 4' + 3-1/5' + 2-2/3'. The stop is usually made without breaks in the ranks, but some do break back an octave at c'.
See also **Stop**

Edward L. Stauff

THAYSSNER, ZACHARIAS (FL. 1668–1705)

German organbuilder; also named Deissner, Theussner, Theissner, Tayssner, or Theyssner. He was probably the son of Andreas Thayssner the Elder (active 1674–1703) of Halle. Zacharias Thayssner became the most prominent member of the family. He established his first workshop in Quedlinburg, then moved it to Merseburg. In his *Musikalisches Lexikon* (1732), Walther mentions an organ built for Jena, Collegen-Kirche; the "large and valuable instrument in Merseburg Cathedral" (1702), and the organ at Naumburg, St. Wenzel's, which Thayssner moved from a position on the side of the church into its location opposite the altar. For this work the Naumburg city officials gave him a printed certificate in 1705, the year he died in Saalfeld.

Little remains of Thayssner's work; the cases of both Naumburg and Merseburg cathedrals survive. The extant specifications of his instruments reflect the north German Werkprinzip, the use of several reed stops, and the inclusion of characteristically central German stops, such as the Viola da Gamba and Flaute Douce. Thayssner's work was praised by such prominent musicians as Buxtehude (1695) and Friedrich Wilhlem Zachow, who considered his organ for Merseburg, Vitikirche on the Altenburg a triumph. In contrast, however, others criticized the winding for the organs at Jena and Naumburg; Dietrich Christoph Gloger mentioned various "shortcomings" in the Merseburg Cathedral organ that he repaired and "improved."

Douglas E. Bush

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THEATER ORGAN

The concept of the theater organ has a long history; for audiences at a performance in the theater at Dion at the foot of Mount Olympus just over two millennia ago, the musical entertainment might well have been provided by a HYDRAULIS. However, it was the advent of silent films in 1895 (hence the alternative name cinema organ), combined with the inventive genius of Robert HOPE-JONES, that brought us the instrument we recognize today. Hope-Jones refined the recently invented electro-pneumatic ACTION, permitting the organ CONSOLE to be placed at a considerable distance from the pipes it controlled; the system of UNIFICATION, which allowed a RANK of pipes to sound at different pitches and on different keyboards; and second touch, allowing the organist to play a melody on the same KEYBOARD as the accompaniment, with a difference in dynamic or tone. He also introduced several new tonal features to the theater organ, including the TIBIA, a rich Flute voice, the DIAPHONE, a smooth and rapidly speaking "suitable" PEDAL bass, the KINURA (a buzzing reed stop), and other characteristic sounds to complement more traditional organ flues and reeds. He concentrated on orchestral-sounding ranks, naming his theater organ the "unit orchestra" as it fulfilled the function of an in-house orchestra or band. The theater organ was used to accompany silent films, lead singalongs, or provide incidental music during intermissions. Its roster of SOUND EFFECTS aided this process greatly.

As the console of a "Mighty Wurlitzer" or similar instrument rose from the depths to thrill cinema audiences at the beginning of the twentieth century, few would give thought to the ingenious mechanisms and array of pipes the musician controlled; to most people, the console *was* the organ. Yet it is a highly complex control center linking the keyboards, pedals, and stops through electric relays to the pipes in the chambers, situated either under, above, or to the side of the screen. These chambers, usually two in number, have a system of shutters that open and close to control the volume.

The most prominent builder of the theater organ was the Rudolf WURLITZER Company, to whom Hope-Jones had sold his patents before his suicide in 1914. There were other many builders, notably Christie and John H. COMPTON in the United Kingdom, Barton, W. W. KIMBALL, MOLLER, and Robert Morton in the United States, and Standaart in northern Europe.

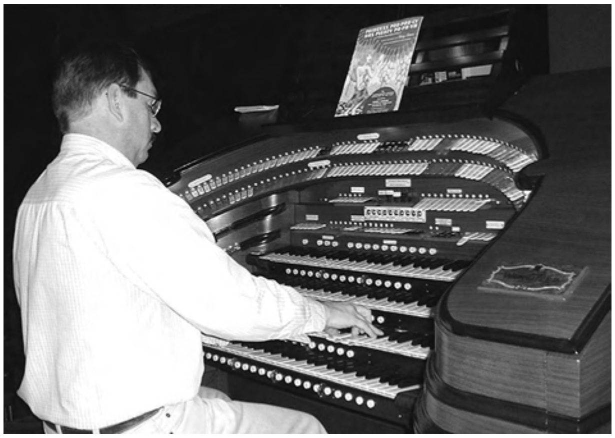

Fig. 74. Kevin King performing on a Mighty Wurlitzer theater organ at the Berkeley Community Theater, Berkeley, California (courtesy of David Reed).

Current American theater organ design involves the revision of larger instruments so that they might be appropriate for all types of music from classical organ repertoire to symphonic transcriptions and even to jazz. While instrument production virtually ceased going in the 1930s after the introduction of "talking pictures," the tonal evolution of the American theater organ continues in reconstituted and revised instruments installed to create the ambiance of the photoplay era. The AMERICAN THEATRE ORGAN SOCIETY was formed in 1955 to champion the wonders of the instrument and the art form that has evolved around it, as well as to aid in conservation and restoration efforts.

Some prime examples of extant American theater organs are the Radio City Music Hall's Wurlitzer organ (4/58) in New York; the Moller (4/42) in the Fox Theatre, Atlanta; the Wurlitzer (4/20, double console) at the Paramount Theatre, Denver; the AUSTIN (4/75) at Bushnell Memorial Hall, Hartford, Connecticut; the ÆOLIAN-SKINNER (4/71) at the Hershey, Pennsylvania, Community Theatre; the Barton (4/24) in the Rialto Square Theatre, Joliet, Illinois; the Wurlitzers of the Orpheum (3/14) and El Capitan (4/37) Theatres in Los Angeles; the PILCHER (4/85) at Memorial Auditorium, Louisville, Kentucy; the W. W. KIMBALL (3/38) at the Oriental Theatre, Milwaukee, Wisconsin; the Wurlitzer (4/27, double console) at the Paramount Theatre in Oakland, California; the Wurlitzer (5/21) at the Providence, Rhode Island, Performing Arts Center; the Robert Morton (4/23) at the Saenger Theatre, Pensacola, Florida; and the Wurlitzer (4/21) at the Castro Theatre in San Francisco.

JOHN FOSS
ALBERT F. SEFL
DAVID REED

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THEOPHILUS

A monk who presumably lived in Germany or eastern France during the first half of the eleventh century. Theophilus wrote a large treatise, *De Diversarum Artium Schedule*, in which he describes the production of objects for the church, such as painting, gilding, glass blowing, the casting of bells, and organ building. The section on the organ describes in great detail the fabrication of PIPES, WINDCHESTS, SLIDERS, and the WINDING mechanism.

Copper pipes were beaten very thin and fitted around a conical iron mandrel. The edges were soldered together, but as there is no indication of a separate foot soldered to the body of the pipes, the shape was probably that of a regular cone. The pipe diameters were identical, and the pipes of equal length from the languid down, suggesting a restricted compass; the tone of each pipe was adjusted by enlarging the mouth for a fuller sound and narrowing it for a thinner sound. The resulting instrument would have been "old-fashioned" in sonority (more rough than sweet).

Theophilus gives instructions for making windchests of both copper and wood. He provides for several ranks of pipes for each note, although there is no mechanism for separating individual ranks, as in the system described by VITRUVIUS. Wooden sliders with perforations corresponding to the number of ranks were fitted into channels in the chests; each slider handle was marked with the letter of its position in the scale. There was no key mechanism attached to the sliders, so they must have been pushed in by the organist to block the passage of air to the pipes and pulled out to admit air into the pipes, much like the HYDRAULIS.

Theophilus next discusses the winding process. The winding mechanism was encased in a "conflatorium," an air-collecting structure in which a set of forge (blacksmith's) bellows fed air through tubes into a central channel; the air pressure was controlled by valves on the tubes.

Theophilus concludes his discussion of the organ with directions for placing the instrument on the wall of a monastery church. The bellows and organist were located in an archway cut into the wall; only the windchest and pipes were visible to those in the nave of the church. The organ was covered with a thick curtain when it was not in use. A pulley system enabled the curtain to be lifted by a rope when the organ was played.

A rather free reconstruction of Theophilus's organ (1999) by Winold van der Putten, a former student at the REIL firm, is now located in Marsum, Groningen, Netherlands. In addition to Theophilus, the builder borrows from other sources: *De fistulis Organis*, from the Bern manuscript (tenth century); Hero of Alexandria (first century CE); and an illumination from the Rutland Psalter, ca. 1260, showing King David playing at the proto-keyboard of a small organ of two ranks, winded by a pair of bellows upon which the "blower" shifts weight between one foot and the other. Van der Puttenhas used available information (no single source is definitive) as well as historic precedents and logic to produce an instrument that would not have been recognized by Theophilus, but brings the unusual idea of neomedieval organ-building to life.

See also Medieval and Renaissance organ

KIMBERLY MARSHALL

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THIERRY

Parisian organ-building family; also spelled Thiéry. Pierre Thierry (1604–1665) studied music with Florent Bienvenu, organist of Ste Chapelle, and apprenticed to Valeran DE HÉMAN in 1623. He worked with Crespin CARLIER at St. Nicolas-des-Champs 1634–35), then he set up his own shop and worked at Notre Dame, St. Jean, and St. Gervais, all in Paris. At St. Gervais, he added a 4' Pedal stop in 1649, completing the organ in 1661.

Pierre's organ at St. Paul, Paris (1644–46) was a blend of the old Flemish-derived style of northern France and the newer indigenous French style. Originally, this instrument contained an undeveloped pedal, no 16' reed, and two toy Nightingales. Pierre also developed a wide-scaled Tierce useful for solo work; his St. Paul organ had a Tierce on the Positif and two Tierces on the Grande Orgue, two mixtures on each manual, and a half-manual for the Récit. From 1659, under the supervision of Louis Couperin, he re-worked and added a Jeux de tierce to the Positif, added an Echo division, added notes to the Pédale and Positif, and added a pedal coupler.

Among his other important instruments were those of the Hôtel-Dieu at Pontoise (1637–41) and the Church of the Mathurins, Paris, which contained the first combined windchest for Récit and Grand Orgue. He introduced a Grand Écho division of seven stops at Rouen Cathedral. His masterpiece, however, was for St. Germain-des-Prés (1661). Upon the death of Pierre Desenclos in 1664, Pierre became *facteur du roi*, builder to the king.

Pierre's son Jean Thierry (1638–1689) set up his own workshop after his father's death. His most notable instrument was that of St.-Père de Chartres. Another son, Alexandre Thierry (1646/47–1699), established himself as the leading French organbuilder with the completion of the organ of St. Séverin. He worked at St. Gervais in 1674 and 1685, creating an organ whose disposition was used by François Couperin in his organ masses. Alexandre also built the organs at St. Louis-des-Invalides and St. Eustache, and created a four-manual organ for St. Germain-des-Pres in 1663. These instruments embodied the quintessential standardized French classical organ that came into being through an amalgamation of Parisian and provincial builders. Later in his career, he worked with Hippolyte Ducastel and Robert and Jean-Baptiste-Simon CLIQUOT. Charles Thierry (b. 1641), third son of Pierre, helped Alexandre build the organs at St. Séverin and St. Germain-des-Pres; he added a signature Trompette to the latter (now part of the organ at Paris, St. Merri).

François Thierry (1677–1749), son of Alexandre Thierry, rebuilt the Paris, Notre Dame, organ with a separate, powerful Bombarde division, the first of its kind. This innovation incorporated a Bombarde 16', Trompette 8', Clairon 4', and Cornet V, all coupled to the Grand Orgue; the instrument helped him achieve great fame. Andreas SILBERMANN worked for him between 1704 and 1706 (Orléans Cathedral), taking from this French classical ideas that eventually reached Saxony, Leipzig, and Dresden. In 1714, François renovated the organ at St. Gervais, adding a Trompette de Récit at François Couperin's request; this stop was later transferred to the Écho by François-Henri Cliquot. Later in his career, he worked at Beauvais, Reims, and Tours. His work bridged the early French classical organs to the high art of Cliquot.

BRIAN DOHERTY

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THOMAS ORGAN COMPANY

Canadian organ- and piano-building firm. John Morgan Thomas (ca. 1805– 1875), who began a workshop in 1832 in Montreal, built new headquarters for the firm in Toronto in 1844. His son Edward G. Thomas (d. 1891) took over the firm after John Morgan's death. Described as "Canada's favorites," the company's organs formed the basis of a thriving export business with constituents of the British Empire (including the United Kingdom) and many other parts of the world. In 1891 James Dunlop became a partner in the firm and subsequently its owner in 1895, when its name was changed to the Thomas Piano and Organ Company. In 1900, factory production was 150 organs per month; by 1904, manufacturing facilities and output had doubled. The firm built REED ORGANS of all sizes, advertising in 1915 a two-manual and pedal instrument for church or home use. In 1915 various one- and two-manual organs were advertised, and in the 1920s the company produced the Thomas Orchestral and Symphony reed organ as well as a portable model. Thomas organs were notable for their incorporation of "Howard's Melody or Solo Organ" stops, invented by Samuel Howard, originator of various improvements to the reed organ and founder in 1901 of the Melody Organ Company, Ltd. This system, which could be incorporated in any organ, allowed the player to emphasize the highest or lowest note of a chord or melody at will. According to an article in the October 1904 *Musical Opinion*, the stops enabled the player of a single manual organ to produce effects usually possible only on a two-manual and pedal instrument.

JAMES HOWARD RICHARDS

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THROAT

The widest area of a wooden FLUE pipe's WINDWAY, fronted by the cap and backed by the block; like every element of the MOUTH, it affects the tone of the pipe.

THUNDER PEDAL

See Donner/Sturm/Storm or Thunder Pedal

THURINGIA

Southwestern region of Germany (Thuringen), a state in the reconstituted Federal Republic (1990); historically, a series of principalities within Saxony that joined the German empire (1871), then was combined into a single Bundesland after World War I. Except for a period when Weimar was its capital (1920–48), Erfurt was and continues to be its capital and cultural center. As part of the postwar German Democratic Republic, Thuringia was divided into large districts (1952), then reunited as a state. While organ building here was influenced by Baroque trends, its relative geographical distance from northern Germany, the LOW COUNTRIES, and FRANCE encouraged a very active, somewhat conservative local trade; like other regions in Europe, the balance toward more cosmopolitan trends began with the influx of instruments built outside the region in the nineteenth century.

Thuringia's special place in organ history derives from Johann Sebastian Bach's birth here (Eisenach, 1685), his having spent most of his youth in Eisenach and Ohrdruf, and his having his first positions here (Arnstadt, 1703–07; Mühlhausen, 1707–8; Weimar, 1708–17) before moving on. The first two towns were of modest size, and neither of the organs that Bach played survived intact. At Arnstadt, he was the first organist at the Neue Kirche (Bonifaciuskirche) to play on the new Johann Friedrich WENDER organ (1703; 2/23, Brustwerk rather than Positiv); the instrument underwent a history of expansion, alteration, and neglect over the nearly three centuries that followed. Finally, the process of separating the original Wender from the 1913 STEINMEYER rebuilding took place; the console, case, and one quarter of the original registers had survived, and were incorporated into a reconstructed instrument by the Hoffman firm of Ostheim von der Rhön (1997–99), using stoplists from other Wender organs to complete the registration. The church in which it is located is now known as the Bach-Kirche.

At Mühlhausen's Blasiuskirche, Bach made suggestions (that survive in written form) for registration and structural alterations to the instrument; Wender, a Mühlhausen native, carried these out after Bach's departure for Weimar. (This instrument was subsequently dismantled, but the SCHUKE firm reconstructed the instrument from Bach's instructions and other sources in 1959.) In Weimar, Bach served as court organist (later adding the role of concertmaster), and wrote much organ music there. The instrument he encountered had been built by Ludwig COMPENIUS (ca. 1658) and overhauled just before Bach's arrival. In 1712, Bach convinced the court to hire Heinrich Nikolaus TREBS, whom Bach had known in Mühlhausen, to rebuild the instrument entirely; the organ was ready two years later. The instrument underwent changes after Bach's departure; it was later destroyed by fire.

The first documented Thuringian builder was STEPHAN KASCHENDÖRF, active in Erfurt (1480–84). J. de Berge built an instrument at the Augustinian abbey in Bad Langensalza in 1494. Bertoldo Heringen (Barthold Hering) emigrated from central Germany to Nordhausen by about 1500; he built an instrument for the Serviten-Kloster Himmelgarten (contract, 1506), destroyed during the Peasant War (1524–25). He eventually moved on to Lübeck, in northern Germany, where he built organs, served as organist, and died in 1556.

In the next two centuries, Thuringian builders included Laurentius Daum of Mühlhausen (ca. 1494–1553); Daniel Meyer of Göttingen (Schmalkalden, Schloss Wilhelmsburg, 1583); Nicolaus Goeppel of Nordhausen (sixteenth century); Ezechiel Greustscher (Nordhausen, St. Nikolai/Marktkirche, 1619); Josias Ibach (Altenburg, Schlossorgel, seventeenth century); and Johann Andreas Vetter of Nordhausen (seventeenth century). Several members of the important Compenius family were born in Thuringia, and some remained—notably Heinrich I (ca. 1525–1611), who played at Martin Luther's funeral and built an organ for Erfurt's Predigerkirche (1579), and Ludwig, who built organs for Altenburg, Erfurt (played by Johann Pachelbel), Gera, and Weimar (played by Bach; see above). In addition to his associations with Bach, Wender contributed organs to Bollstedt, Dörna, Erfurt, Merseburg, and Seligenstädt am Main, and repaired the organ at Weimar's Stadtkirche. The composer Johann Kuhnau considered him and Andreas SILBERMANN the greatest builders of his time.

In the latter seventeenth and eighteenth centuries, Thuringian builders began to draw upon the work of the Silbermanns, especially their synthesis of north German and French registration practices. Three Gottfried Silbermann instruments in eastern Thuringia survive in original condition or disposition (Ponitz-Schmölln, Friedenskirche, 1737, rest. 1985; Fraureuth, 1742; Schleiz, Burgk castle, 1743, rest. 1982); others were destroyed by fire (Reichenbach, Trinitatiskirche, 1730; Greiz, Stadtkirche, 1739) or rebuilt beyond recognition (Reichenbach, Stadtkirche, 1725; Glauchau, Georgkirche, 1730; Mylau, Stadtkirche, 1731). On the other hand, the treatises on organ building and tuning published by Lobenstein organist Georg Andreas SORGE increased the visibility of Thuringia throughout the organ-building world.

Another builder active at this time was the Altenburg court organbuilder T. H. G. TROST, who built the court instrument inspected by Bach and Johann SCHEIBE in 1739. The STERTZING family of Ohrdruf and Eisenach was prominent—especially Georg Christoph, who built instruments for Johann Christoph Bach and Johann Nicolaus Bach, and whose only surviving instrument was built for Erfurt, St. Peter's (1700–1702; to Büssleben, 1811; rest. 1998–2002). His Erfurt, Augustinerkirche organ (1715–16) was completed by Johann Georg Schröter (1683–1748), an Arnstadt builder active throughout Thuringia. Other builders included Trebs, the Dauphin family (eighteenth century), the Heinemann family of Grosslöbichau (eighteenth century), and the BECK family (especially Johann Caspar Beck) and their successors, the Holland family and Johannes Michael WAGNER (nineteenth century). The Poppe family of Roda began building organs in the mid-eighteenth century; the sons of Christian Friedrich Poppe (1751–1812) formed Gebrüder Poppe upon his death, in turn succeeded by Ernst Poppe und Sohn (1889–1928); several of their later instruments survive.

The Napoleonic Wars damaged churches and instruments throughout Germany, and Thuringia suffered its share of losses. But this was only one of several factors in the Thuringian organ-building boom of the nineteenth century. Nationalism grew, first as competition between duchies and principalities, then in the unification of Germany (1871). The surge in civic pride combined with economic prosperity among the middle classes to create new churches (now more municipal than clerical in orientation) and new instruments; in addition, this stimulus encouraged the replacement of older instruments at a time when modernity equaled progress. Nineteenth-century historicism aside, Europeans still believed in "improving the organ" with new technological (e.g., pneumatic) resources. In addition, the theoretical and practical work of Sorge on organ building was furthered by the even more prolific Johann Gottlob TÖPFER, a native of Niederrossla who served as city organist in Weimar.

The nineteenth century saw the increasing presence of builders from outside the Thuringian area, especially after German unification. The most important major firms were E. F. WALCKER, founded in 1781 (in Ludwigsburg, Württemburg by 1821), and Wilhelm SAUER, who founded a workshop in Frankfurt an der Oder (1857). While they never completely monopolized the German market, their modern Romantic style had a pervasive influence on Thuringian builders. Numerous local firms flourished in and around the region; in addition to those continuing from the previous century, such as the TRAMPELI family, there were the Knauf family of Bleicherode, the Ratzmann family of Ohrdruf (who taught Wilhelm Sauer's father), and the Schuke and SCHULZE firms. Friedrich LADEGAST spread the influence of Aristide CAVAILLÉ-COLL and new technology such as the BARKER LEVER and cone-chests in the relatively small number of organs he built for the region. The Peternell brothers (Carl August and Wilhelm) worked in Selighthal, installing instruments in Thuringia and Lower Saxony in the latter nineteenth century.

After the death of Benjamin Witzmann of Stadtilm (1782–1814), court-appointed organbuilder of his city, his workshop was taken over by his son Karl August Witzmann (1809–1881). Adam Eifurt married Karl August's daughter and took over his father-in-law's firm in 1870, becoming the Saxon court's official builder. He was followed by his nephew Johann Eifurt (1870–1944). After twenty years of ownership by Lothar Heinze (1905–69), the present owner, Karl-Heinz Schönefeld, took over, keeping the firm in Stadilm, constructing new and restoring nineteenth-century pneumatic instruments, and building new tracker action organs.

The Markert family, originally from Bavaria, became a significant firm in the region. Johann Georg Markert II (1813–1891) settled in Ostheim von der Rhön; he was appointed Thuringian court builder in 1851. The bulk of his work was for the Eisenach environs, including the local synagogue. His son Otto Markert (1860–1944) took over in 1886; while advanced in his use of cone-chests, he retained tracker action for his instruments until 1914. Johann Georg's grandsons Louis Hoffmann (1906–1965) and Otto Hoffmann (b. 1913) studied organ building and returned to the Ostheim workshop at the end of World War II, but lost their Thuringian market after the postwar division of Germany. They returned to using slider-chests and pursued other markets. In the 1970s, Otto and his sons Horst and Günter Hoffmann began making a reputation as restorers; in 1985 Otto retired, leaving his sons in charge. In Schmiedefeld, Michael Schmidt founded a workshop around 1835; it was taken over in 1872 by the Kühn firm, who in 1902 also took over the Holland firm that had succeeded the Beck and Wagner workshops. The Kühn family continued ownership, moving to Schleusingen (1908) and opening a second workshop in Merseburg (Saxony-Anhalt); with the death of Gerhard Kühn, a grandson of the founder, the Schleusingen workshop closed.

The humiliating defeat of Germany and its allies in World War I had tremendous economic and psychological consequences for the nation. Organ building had come to a halt during the war; now, resources were limited for the repair or replacement of organs, not to mention new instruments for new churches. The grandiosity of late Romantic culture now seemed absurd. The 1920s proved a fertile ground for the antiromantic, pro-Bach leanings of the ORGAN REFORM MOVEMENT, voiced as early as 1905–06 by Albert SCHWEITZER. These factors led to experimentation with older registration styles, electrification of pneumatic systems (and later a return to tracker actions), and elimination of ornamented casework. After World War II, the consequences of the reform movement were evident throughout the organ-building world. But, with the incorporation of Thuringia into East Germany, builders who remained were nationalized by that government; they continued to work, but were not in control of the marketing of their instruments or the obtaining of materials.

During communist rule, much emphasis was placed on historical restoration; even now, however, more than a decade after reunification, many Thuringian Baroque organs still require repair or restoration. The traditional German combination of religious fervor and civic pride that has seen the creation of so many substantial instruments for all manner of churches has been supplemented, since the 1930s, by an increasing amount of historical study of the organ, its builders, and its place in society. German and other builders have turned their attention to restoration as never before (as well as modeling their new work on pre-twentieth-century instruments). Weimar has become the home for one of Germany's increasing number of organ museums.

The effects of the war have never disappeared completely, however. In 1939, Johannes Schäfer wrote a chronicle of organ building in the small Thuringian city of Nordhausen am Harz. He noted the presence of instruments in seven churches, both Lutheran and Catholic, as far back as 1542. He could list twenty firms, regional and national, ranging from the Compenius family and Bertoldo Heringen to Heinrich Deppeé and Walcker, who had at some point worked on one or more Nordhausen instruments. When fire, earthquake, disrepair, or the urge for the new meant the end of one instrument, another would soon take its place. The book was published on the cusp of a war that destroyed much of Nordhausen's heritage. By 1945, of the seven churches, two had survived intact; one was partly damaged and rebuilt, one was partially destroyed and allowed to remain that way, and two were was totally destroyed. In the most dramatic case, the Dom zum Heiligen Kreuz was 80 percent destroyed, rebuilt, and reopened 1965; then, following years of listening to an aging instrument and pursuing the usual arguments about choice and expense, the church purchased a "secondhand" 1964 Klais organ, installed in 1996—a blow to civic pride, but, as church members noted, a definite improvement.

RICHARD KASSEL

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TIBIA

(Lat., "aulos," pipe.) (1) In the late eighteenth century, a term found in organ-building contracts in conjunction with descriptors, some more colorful than usual (Angusta, Cuspida, Rurestris, Sylvestris, Vulgaris). The term was revived by Robert HOPE-JONES and other turn-of-the-twentieth-century builders to denote a family of large-scaled Flutes.

(2) By itself, an open, loud, usually wood Flute at 8' on the manuals. On theater organs, it became synonymous with the Tibia Clausa, a stopped Flute ranging from 16' to 1' (unisons) on the manuals and 32' or 16' on the pedal, made of wood except in the highest registers, where open metal pipes are used. The remarkable quality of this rank is its almost complete absence of overtones, with only a touch of the third partial intruding. Its pliant, powerful yet gentle qualities, along with a slowly developing harmonic envelope that reaches a smooth, steady sound undisturbed by competing overtones, have made it extremely familiar to and popular with theater organ aficionados. On the church organ, it is most effective on the Solo division, but of little use in combination. The contemporaneous Tibia Plena is nearly the opposite of the Clausa. It is a powerful stop fueled by huge proportions, thick walls, and high wind pressure, suitable even for a cathedral. An open wood

Flute-Diapason hybrid with a rich set of partials, it is versatile; it functions with emotional clarity as a solo stop, but is remarkably effective as a support for reed or flue choruses, particularly by supporting lower partials for stops with weakness in that region. Perhaps its most remarkable ability is to "disappear" tonally as it builds up a particular ensemble.

TIERCE

A wide-scaled mutation speaking at 1-3/5' always found on the Grand Orgue and Positif divisions of later-seventeenth- and eighteenth-century French organs. The Tierce 1-3/5' was the crucial element in the Petit Jeu de Tierce (available on both the Grand Orgue and Positif) and an important element in the Grand Jeu de Tierce (available on the Grand Orgue) registrations. Various Tierce registrations are commonly employed in Duo, Trio à deus dessus, and Tierce en Taille pieces of the era.

See also **Jeu de Tierce/Cornet**

JESSE E. ESCHBACH

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TIN

SEE PIPE METAL

TIRASSE

(Fr. *tirer*, to pull.) Manual to pedal coupler. The Tirasse from the Grand Orgue (GO) was established in French classical organ building and became commonplace in the early decades of the nineteenth century. Early contracts of Aristide CAVAILLÉ-COLL imply a self-conscious use of the Tirasse, explaining that the basses of the manual stops could be united with the pedal stops. The nineteenth-century Tirasse was activated by a hitch-down *pédale de combinaison*, most often situated immediately to the right of the Orage pedal. Tirasses of the nineteenth century were invariably "dependent," pulling down not only the manual to which the pedal was directly coupled, but also any other manual coupled to the original manual. In other words, a nineteenth-century organist could make one adjustment to progress from Pédale Solo to Pédal GO/P/R, or vice versa, assuming both Positif (P) and Récit (R) were already coupled to the Grand Orgue. In early and middle-period instruments (through at least 1875), only the Grand Orgue, or possibly the Positif, was equipped with a Tirasse. By the 1880s a separate Tirasse to each manual division became standardized in the work of Cavaillé-Coll, although the Tirasses remained dependent.

JESSE E. ESCHBACH

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TIRATUTTI

SEE ITALY

TITZ, PETER (1823–1873)

Austrian builder of reed organs. Titz founded a family firm active well into the twentieth century. He served his apprenticeship with Jacob Deutschmann (fl. ca. 1825–after 1883), who built harmoniums and SERAPHINES in Vienna; an instrument of his manufacture was displayed at London's 1851 Crystal Palace Exposition as a "melodium." Titz was still active as Deutschmann's apprentice in 1851, but was building harmoniums under his own name by 1852. The business was highly successful, producing a variety of organs until Titz's death, when his son-in-law Teofil Kotykiewicz (1849–1920) assumed control of the firm. Upon his death he in turn was succeeded by a son of the same name (1880–1971).

The Titz company produced a complete line of REED ORGANS, making harmoniums as well as "American organs" built on the vacuum principle. Its line of organs culminated with a three-manual and pedal instrument of forty stops. A 1903 advertisement for the

Kotykiewicz firm displays a two-manual organ with three knee levers and nineteen stop-knobs. Attention is called to the maker's (probably honorary) title and his production of first-class organs, from the largest to the smallest. Disposition of the stops and other controls can be arranged according to the client's wishes. Features available include three-manual construction, *prolongement* throughout, *prolongement automatique*, *grand sourdine* (in which the WINDCHEST pressure can be greatly reduced, causing the reeds to speak softly—possible because WIND PRESSURE does not affect the pitch of FREE REEDS), motor-driven BELLOWS, and all "modern innovations."

JAMES HOWARD RICHARDS

TOE

In FLUE and REED pipes, the bottom-most section of the pipe, which rests on the TOE BOARD and is held in place by the RACKBOARD. In flue pipes, when the appropriate pallet is opened, air from the WINDCHEST flows though the toe hole (bore) through the FOOT into the WINDWAY, the area created by the cap (in front) and block (in back). Eventually the air passes through the mouth, passing the lips with sufficient power and edge tone to produce pitched tones. In reed pipes the process is initially the same, although the section above the toe is called the BOOT. Thereafter, the SHALLOT and tongue, wedged into a block at the top of the boot (rather than a mouth), generate the vibrations that, coupled with the air in the resonator above, result in pitched tones. Most pipe toes are made of metal, including wooden flues.

RICHARD KASSEL

TOE BOARD

The wooden top surface of a WINDCHEST; the plank on which the pipes rest on beveled holes; also called an upperboard. The pipes are held in place by a RACKBOARD, parallel to the toe board and located at the foot (most frequently) or above the mouth (less frequently). In the classical pipe organ, KEY ranks of shared pitch line up front to back, while stop ranks move along the side-to-side SLIDER paths.

JOHN POWER

TONE CHANNEL

SEE KEY CHANNEL

TONGUE

SEE REED

TÖPFER, JOHANN GOTTLOB (1791–1870)

German organbuilder, composer, organist, and theorist. Born in Niederrossla near Apolda, Thuringia on 4 December 1791, Töpfer grew up in a period of constant warfare in Europe (1792–1815), leading to the destruction and confiscation of churches and ecclesiastical wealth. Organ building was in a state of disarray by the time Töpfer was a young man. Friedrich Wilhelm TRAMPELI's unsuccessful instrument in the Weimar Stadtkirche (1812) stimulated Töpfer's innate interest in undertaking research and experimentation in organ building; subsequent publications made him the most respected nineteenth-century German authority on the subject.

In 1817 Töpfer was appointed teacher of organ and composition at the Weimar Lehrerseminar as well as deputy organist at the Stadtkirche. He became principal organist in 1830, and held both posts until his death. In 1845 he published an organ method book, the *Theoretisch-praktische Organisten-Schule*. His compositional style evolved into the Romantic, demanding technical mastery (e.g., obbligato pedal-playing) and seriousness of purpose. His compositions, which won the admiration of Franz Liszt, include a sonata (1845), preludes and fantasies, fugues, chorale preludes, and three large-scale fantasias (published 1859), anticipating Reger's works in that genre.

Töpfer's organ-building treatise, first published under the title *Die Orgelkunst* (1833) and based on François BÉDOS DE CELLES's *L'art du facteur d'orgues* (1766–78), grew through several editions into the comprehensive *Lehrbuch der Orgelbaukunst* (1855), containing text and diagrams dealing exhaustively with every aspect of organ building. All subsequent nineteenth-century central European organbuilders were indebted to this work. His standardization of pipe scales, adopted by some builders and denounced by others, contributed on the one hand to the signature German Romantic organ sound, and on the other to mass-produced commercial organs of poor quality. Töpfer's *Anleitung zur Erhaltung und Stimmung der Orgel* (1840) provided instruction on tuning organs; *Die Orgel: Zweck und Beschaffenheit . . .* (1843) offered guidance for organists and clergy who had to contract for and maintain organs. He died in Weimar on 8 June 1870.

See also **Scaling; Sorge, Georg Andreas**

QUENTIN FAULKNER

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TOUCH

See Action; Keyboard

TOY STOPS

(Ger. *Nebenregister*, accessory stops.) A broad term for sounding and nonsounding effects stops. The English term is associated with THEATER ORGANS (which, after all, were most common in English-speaking regions); the concept has since been extended to include devices found in church organs as early as the late Middle Ages. One can go further back to find that the earliest hydraulic organs were constructed with movable figures.

According to Mahrenholz, one should differentiate between sounding stops and "silent" stops, which only produce an optical effect. Sounding toy or accessory stops include the BIRD WHISTLE (VOGELGESANG, NIGHTINGALE), ORAGE, and ZIMBELSTERN, and percussion stops including the CELESTA, CHIMES, DRUM PEDAL (PAUKE, imitating the timpani), and, perhaps, Arnolt SCHLICK's mysterious "hültze Glechter," the "small boys hitting a pot with a spoon."

Purely visual effects involve rising suns, moons, and stars; movable putti (cherubs and other angels, sometimes soldiers); birds moving over the organ case or stroking their wings (German organs used a preening or crying rooster in a liturgical context during the Easter Passion oratorios; one was incorporated in the Joachim WAGNER organ of the Berlin Garnisonkirche, 1726). Some of the moving putti held instruments, mostly trumpets and timpani; sometimes these instruments actually sounded or were made to sound through pipes inside the organ. One of the most famous toy-stop organs was the "Sonnenorgel," built by Eugenio CASPARINI in Görlitz (1704; reconstr. 1997), with eighteen suns of different sizes, most of them moving and sounding, with Pedal mixture pipes on their hidden sides.

MECHANICAL ORGANS of all kinds featured toy stops, from small bird automata to the fairground and band organs and calliope; perhaps the most famous of the toy stop–festooned variety was the so-called "Organ of the Sultan," by Thomas Dallam and sent by Elizabeth I from England to Constantinople in 1599–1600 as a political gift to Ottoman Sultan Mehmet III.

Most of the toy stops in organs of western and northern Europe disappeared during the nineteenth and early twentieth centuries, but they survived in Italy, Spain, and eastern European rural churches. A wide variety of new toy stops, made possible by electricity, were incorporated into the twentieth-century theater organ.

CHRISTIAN AHRENS

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TRACKER

A strong, flexible wood strip used in suspended and balanced mechnical ACTIONS; the tracker pulls rollers, pallets, BACKFALLS, and other devices, transmitting motion and therefore maintaining direction. It may be used vertically or horizontally. The term dates from at least the early nineteenth century; Baroque terms included "trigger" and "ribs."

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TRACKER GUIDES AND HANGERS

See Action

TRAMPELI (TRAMPEL)

Saxon organ-building family. Paulus Trampel (1708–1764) took over Adam Heinrich Gruber's workshop at Adorf in 1734; the Trampelis would continue to work there. Paulus is reported to have built fity-two organs (probably including rebuilds), none of which, however, are extant. His son, Johann Gottlob Trampeli (1742–1812), was undoubtedly the most distinguished member of the family. He and his brother Christian Wilhelm Trampeli (1748–1803) were the first to use Trampelias a last name. The brothers had completed fifty-four instruments by 1796 (including a three-manual, forty-eight-stop organ for Leipzig, St. Nikolai); of these, five instruments (all two-manual) still substantially exist: Arnsgrün (1784), Hohndorf (1788), Stangengrün, Rothenkirchen (1796), and Oberlosa, near Plauen (1784–88). The specification of the Oberlosa instrument is as follows:

Hauptwerk (C-d''')

Principal	8
Gedackt	8
Viol di Gamba	8
Octave	4
Spitzflöte	4
Quinta	3
Octava	2
Flageolett	1
Cornett	III
Mixtur	IV

Oberwerk (C-d''')

Principaldiscant	8
Quintatoen	8
Lieblich Gedackt	8
Principal	4
Flauto	4
Nassat	3
Octave	2
Sesquialter	II
Mixtur	III

Pedal (C-c')

Subbass	16
Violonbass	16
Principalbass	8
Posaunenbass	16

Thereafter Johann Gottlob worked alone, and from this period five smaller instruments are still extant; but unfortunately, nothing remains of the large instrument at Dortmund, St. Reinholdi (3/40). The final representative of the family was Friedrich Wilhelm Trampeli (1790–1832), son of Christian Wilhelm Trampeli, who assumed leadership of the firm upon the death of his uncle. Although several of his smaller instruments are preserved, his lack of experience together with the unstable political situation during the early nineteenth century led to several short-lived larger instruments (Plauen, St. Johannis; Weimar Stadtkirche) that were criticized for both tonal and mechanical shortcomings.

Although it cannot be proved that any member of the family apprenticed with Gottfried SILBERMANN, the influence of the great Saxon builder is clearly evident in both the structure and tonal characteristics of Trampeli instruments; a posthumous report claims that Johann Gottlob discovered a treatise by Silbermann while rebuilding his organ at Reichenbach, and subsequently made use of it.

QUENTIN FAULKNER

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TREBS, HEINRICH NIKOLAUS (1678–1748)

Thuringian organbuilder; also spelled Tröbs(t). Not much is known about Trebs (born in Frankenhausen on 10 August 1678), apart from the few organs he is known to have worked on. His historic importance is based on his association with Johann Sebastian Bach; the two were certainly together during Bach's stay in Mühlhausen, immediately preceded the latter's departure to Weimar (1708). Trebs arrived in Weimar in 1709, probably at Bach's request. He and Bach collaborated on a new instrument at Taubach, Dorfkirche (1709–10; 2/11); Bach inaugurated that organ on 26 October 1710. In 1711 Bach gave Trebs a handsome testimonial, and in 1713 he and Johann Gottfried Walther became godfathers to Trebs's son.

However, Trebs's greatest claim to fame is his rebuild of the Weimar palace chapel organ (Ludwig Compenius, ca. 1658) at the instruction of Bach himself. A contract for the alterations was signed on 29 June 1712. Of this rebuild little is known, except that either Bach or the duke of Weimar had determined that the instrument should include a Glockenspiel, and that great trouble was taken over obtaining bells from dealers in Nürnberg and Leipzig. Trebs's work was playable by the middle of 1714 (2/24), having completed two weeks of tuning by May and received final payment in September.

Trebs and Bach collaborated again in 1742 when Trebs was building the organ in Bad Berka. He died and was buried in Weimar on 18 August 1748.

JÜRGEN EHLERS
DAVID SMIT

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TREMULANT

A stop action that produces a tremolo (vibrato) effect. The general principle is to cause a vibrato effect by altering the flow of wind to the pipes. The earlier system (Fr. *tremulant fort*, strong tremolo; Ger. *Bocktremulant*) dates from the sixteenth century. At the end of the duct leading from the main bellows, a wooden spring-loaded flap ("floating plate") presses against an opening in the board of a small bellows (pneumatic motor) connected to the wall of the wind duct. When the stop is open, the flap is free to be pushed up as the air flows through. When enough air has passed through the duct to the windtrunk, a weight on a spring closes the flap, stopping the airflow; then the cycle begins over. The rapid repetition of this pattern causes a tremolo in the actual sound.

The later system (*tremulant doux*, soft tremolo) places a hinged flap (again controlled by a small bellows) within the windtrunk itself. An adjustable exhaust port on top of the bellows (opposite to the windtrunk) is closed by a weighted spring. When the stop is on, the spring is free to move upward, allowing some wind to exhaust through the port; the weight reverses the spring's direction, closing the port and allowing the airflow in the windtrunk to continue freely. As with the *tremulant fort*, rapid repetition causes a fluctuation in sound.

In early English organs, the tremulant was known as the "shaking stop." It is not to be confused with *Schwebung*, which is best defined as the vibration of a clavichord string to cause subtle changes in pitch.

Marco Tiello
Richard Kassel

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TRETZSCHER, MATTHIAS (1626–1686)

Bohemian-born German organist and organbuilder. Born in Lichtenstadt (now Hroznetín, Czech Republic) on 23 March 1626, Tretzscher's widowed mother married organbuilder Jakob Schedlich (Annaberg, St. Anna, 1636). Tretzscher began an apprenticeship with his stepbrother Andreas Schedlich in Joachimsthal in 1641 and later worked for nearly two years with David Schedlich, a relative of Hans Leo Hassler, in Nürnberg. In October 1644 he returned to work with his stepfather, and helped in the building of the organ for Budweis Cathedral (1646, 1/14). In 1647 he began duties as the organist at Joachimsthal, St. Jakobi. Because of his Protestant beliefs, he was forced to leave Joachimsthal on Maundy Thursday, 1650. In 1651 he was appointed organist in Marienberg; by 1653 he had become organbuilder to the court of the Margrave Christian of Brandenburg-Bayreuth. That year he built an organ for the Bayreuth Stadtkirche (2/20). He became a citizen of Kulmbach in 1654, an alderman in 1674, and a churchwarden in 1684. Some of his associates included Tobias Dressel (Falkenstein, Saxony), Johann Wendel Schumeier (Nürtingen, Württemburg), and Daniel Felix Streit (Eibenstock, Erzgebirge). Others who worked in his shop include Christoph Donati, Hans Gruber (Hof), and Hans Purrucker (Marktleuthen). After Tretzscher's death in Lumbach, Upper Franconia, on 9 April 1686, Streit took over his workshop.

Following the Thirty Years' War (1618–48), Tretzscher was the most important organbuilder in Franconia, having built over sixty organs and taught many organbuilders in both Franconia and Saxony. The beautiful cases of his instruments were largely the work of J. Brenck and H. G. Schlehendorf, both of Kulmbach. Some of his organs include: Heilsbronn, monastery church (reb., 2/20); Kulmbach, Petrikirche (1657–61); Strasbourg, Cathedral (reb., 1658–60; 3/28); Schweinfurt, Johanniskirche (1662; 2/18); Coburg, St. Moritz (1665; 2/18); Eger, St. Niklas (1676; 2/30); Kaisheim Monastery (1678; 3/30); and Münsterschwarzach, abbey church, two organs (1685). Much of his effort was aimed at providing small village churches with fine, modest-sized organs.

Douglas E. Bush

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TROMBA

(1) In German and English instruments, an inverted, conical chorus reed at 8' (manuals) and 8' or 16' (pedal); rounder and less brassy than the similar Trombone stop. A bit more powerful than the Trumpet, it is rich harmonically and smooth in tone, effective in solo and ensemble passages.

(2) In Italy, a term synonymous for Trumpet; in Iberia, a more powerful Trumpet stop.
See also **Stop**

TROMBONE/POSAUNE

An imitative chorus reed at 8' or 16' (manuals) and 16' or 32' (pedal), more brassy than the Tromba; uses inverted-conical spotted metal (zinc for the highest registers) with a slender taper. "Posaune," used from the late Renaissance on, was applied more generally to any large reed stop not a Bombarde; Irwin alone makes a distinction between it and the Trombone, the former being "more brilliantly voiced" and using rolled zinc in the lowest registers. Both are considered less brilliant and firm than the Tubas and Trumpets.
See also **Stop**

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TROMMEL

See Pauke/Trommel

TROMPETA REAL

The vertical Trumpet rank, placed inside the case of a Spanish organ. There is some debate as to whether the name should be translated as "royal trumpet" or "real trumpet." Other ranks placed inside the case include Octava Real and Corneta Real. It should not be confused with the horizontal *en chamada* Trumpet rank, which is variously called Clarín, Trompeta de Batalla, Chirimía (at 4' pitch), Trompeta Magna (16'), or Violeta (2').
See also **Reed; Stop**

Calvert Johnson

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TRONCI

Italian family of organbuilders. Antonio Maria Tronci (b. Pistoia, 19 June 1704; d. 16 Apr 1791) and his brother Filippo Tronci I (b. Sabatino, 18 Mar 1717; d. 22 Mar 1788) founded the firm in Pistoia around 1750. The brothers built a four-manual organ for Pisa, S. Stefano (1733), although they are better known for their organ at Pistoia, S. Maria delle Grazie (1755; rest. Tsuji and Pineschi). Filippo I built an instrument alone at Pistoia, S. Filippo (1745; rest. Tsuji and Pineschi).

Luigi (I) Tronci (b. Pistoia, ca. 1755; d. 23 Oct 1803) and Benedetto Tronci (b. Pistoia, Dec 1756; d. Florence, 4 Mar 1821), sons of Antonio Maria Tronci, succeeded their father. They built their masterpiece at Pistoia, S. Pietro Maggiore (ca. 1815; 3/65; two pedalboards). After inheriting the firm, Filippo Tronci II (b. Pistoia, 12 July 1795; d. 25 Apr 1847), son of Luigi Tronci, built organs at Montpulciano Cathedral (1840) and Pistoia, S. Bartolomeo (1844). Luigi I, in collaboration with Benedetto, also built numerous organs for churches in Syria and Palestine. Following Filippo II's death, the firm was taken over by his sons, Luigi Tronci II (b. Pistoia, 23 Aug 1823; d. 3 Jan 1911) and Cesare Tronci (b. 6 June 1827; d. 10 Dec 1874); they built an instrument at Pistoia, Montagnana (1856; rest. Tsuji and Pineschi).

The Tronci family had numerous pupils, including Pietro Agati, who later founded his own organ-building workshop in Pistoia in 1759. A close affiliation between the two families developed, resulting in a merger of the Agati and Tronci firms in 1883. The newly formed Agati-Tronci firm, now headed by Filippo Tronci III (b. Pistoia, 27 Feb 1849; d. Lucca, 7 July 1918), son of Luigi Troci II, continued to build organs in Italy (Capezzano Pianore, 1895; Corsánico, near Viaréggio, 1899; Capánnori, 1904) as well as South America (Buenos Aires, Teatro Colón) and the Middle East (Jerusalem, Church of the Holy Sepulchre). The firm closed in 1916.

Thomas Cimarusti

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TROST, T(OBIAS) H(EINRICH) G(OTTFRIED) (CA. 1680–1759)

German organbuilder. Trost was a member of a distinguished family of organbuilders that included Christian Förner (1610–1678), builder of the Weissenfels court chapel organ and inventor of the WATER GAUGE to measure WIND PRESSURE. After apprenticing with his father Johann Tobias Gottfried Trost (d. 1721), T. H. G. Trost built the organ in Grossengottern (1714–17, 2/26). He moved his residence to Altenburg in 1718 and became court builder there in 1723. However, he remained active in central Thuringia, winning the contract to build his largest instrument at the Waltershausen Stadtkirche (1722; 3/47; rest. 1998). While it seems likely that Johann Sebastian Bach was familiar with that organ, it is documented that Bach played Trost's organ in the Altenburg castle chapel (1739, 2/37; rest. by Eule, 1974–76) in September 1739, remarking that it was durably built and that the organbuilder had taken pains to voice each stop with its proper tone quality and delicacy.

QUENTIN FAULKNER

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TRUMPET/TROMPETTE/TROMPETE/TROMPETA

A somewhat generic term for a metal (sometimes wood) chorus reed, with a (usually) full-length, gradually flaring (occasionally inverted-conical) resonators, at 16' or 8' pitch (manuals) and 32', 16', or 8' (pedal); a 4' or 2' rank of this type is sometimes labeled Cornett. Builders use the term to describe stops of a wide variety of dynamics and degrees of brightness. Some stops are imitative (Orchestral Trumpet); others include Oboe, Cornopean (an English imitative *cornet à pistons* stop), Silver Trumpet, Tromba, Field (Military) Trumpet, and Tuba. Found in most organs from the mid-Renaissance and a standard part of the GREAT division, the Trumpet might be greater in power and attack (French classical, eighteenth century) or rest en chamade within the case (Iberian). The equality of weight of the lower partials (notwithstanding a fair number of inharmonics) meshes with quickness of speech to produces a bright, brassy sound; the lower pedal registers are quite dissonant, and are often avoided by organists. Nonetheless, the Trumpet works well in louder combinations, because of its relative harmonic purity and animated but not eccentric sound qualities. One of its other names is worth mentioning: the German *Tarantantara*.

See also **Stop**

TSCHANTZ

SEE SCHANTZ

TSCHUDI, BURCKHARDT

SEE SHUDI, BURKAT

TSUJI, HIROSHI (B. 1933)

Japanese organbuilder. Tsuji is known internationally for his restorations and replications of historical organs in Italy and Spain. A graduate of Tokyo's Geijyutsu University in 1958, he apprenticed with the SCHLICKER Organ Company and worked at D. A. FLENTROP before opening his own firm in Japan in 1965. In 1976, he moved the workshop to its present location in Gifu-ken, Shirakawa.

Since 1971, Tsuji has made studies of many historical European instruments, especially those of the Netherlands and Germany. His collaboration with Umberto Pineschi since 1980 has resulted in the construction of three replicas of eighteenth-century Italian organs, as well as the restoration of three TRONCI instruments in Pistoia: San Filippo (Filippo I, 1745); Santa Maria della Grazie (Antonio and Filippo I, 1755); and Montagnana (Luigi II and Cesare, 1856). Tsuji's most recent historical project was the restoration of the anonymous Renaissance organ (1558) in the New Cathedral in Salamanca.

In addition to the Italian and Spanish projects, three other Tsuji organs were built according to the documented measurements of historical instruments: Tokai University (opus 15, 1975), based on Arp SCHNITGER organs in Nieu Schemda and Eenum, Netherlands; Tokyo, St. Paul's Episcopal (opus 17, 1975), modeled after Erasmus Bielefeld's 1731 organ in Osterholz Scharmbeck; and Tokyo, St. Margaret's Episcopal (opus 23, 1980), which contains a Cornetto modeled after that by Christian MÜLLER at Beverwijk, Reformed Church (1756).

Tsuji has published numerous articles in *Organ Kenkyu*, the periodical of the Japanese Organ Society. He is also the author of *The Song of Wind* (1988).

KIMBERLY MARSHALL

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TUBA

From the nineteenth century on, a family of chorus reeds noted for a louder and firmer quality than the Trumpet, otherwise sharing the full-length, gradually flaring resonator of the former; usually made of a soft brass alloy, the stop is found at 16' or 8' (manuals) or 32' or 16' (pedal). While the overtones of the Trumpet are manipulated to emphasize brightness, the Tuba is notable for the balance between its first twelve partials (covering an interval of a twenty-sixth, or three octaves and a fifth), exchanging aggressiveness and brightness for intonation unusually good for a reed stop, cleaner articulation, and superior blending with other stops. Constituents of the Tuba family are the Amour, Clarion, Imperial, Magna (Major), Minor, and Mirabilis. There is some similarity to the Ophicleide, another imitative stop.

See also **Stop**

TUBULAR ACTION

A means of WINDING an organ, developed in the nineteenth century, in which air is forced through a tubular lead conduit to the pallet box with its two pneumatic motors (levers). It was intended to lessen the weight on the KEY action (and organist's fingers) as instruments grew to Romantic size, speed up the action itself, and stabilize the airflow.

Tubular-pneumatic action was an outgrowth of the BARKER LEVER, which introduced a pneumatic motor to operate a separate TRACKER to the pipechest. Henry WILLIS popularized the device (which he had seen at the 1867 Paris Exhibition) through his 1872 organ for St. Paul's, London. Besides the conduit and second pneumatic motor, tubular-pneumatic action introduced a new kind of key mechanism, either a touch box or key pallet, to allow or prevent wind from traveling through the conduit to the pallet box and motors. The former is known as inflate-, pressure- or charge-pneumatic; the latter is called exhaust-pneumatic.

In the earlier system (inflate-pneumatic), the key action simultaneously raises an upside-down spring pallet inside the touch box and shifts a pneumatic pouch into place; this dual action completes the path of the conduit and thus allows a supply of air from the unit WINDCHEST to travel to the pallet box. A primary pneumatic (horizontal) fills up, moving a pouch assembly up to exhaust a path to the secondary pneumatic (also horizontal). The motor collapses, pulling down another spring pallet to allow the air from the windchest (third time) into the upper chest and on to the pipes.

The inflate-pneumatic approach proved sluggish, probably because of its dependence on increasing, rather than decreasing, air pressure. The exhaust-pneumatic system replaces the touch box with a simpler spring pallet, activated by the key directly; when opened, the pallet exhausts the conduit to the pallet box of its windchest air. This loss of pressure eliminates the resistance at the other end of the conduit, where the primary motor (vertically placed) is being pressured by a valve, itself under windchest pressure. As the motor collapses, the valve breaks the airway and exhausts the secondary motor (horizontal), which now collapses, and the pallet it is attached to opens the pallet box, allowing air to reach the pipes.

While the Barker lever became the basis of nineteenth-century developments in French actions, tubular-pneumatic systems were not popular there. The inflate-pneumatic was used in some places when the concept was introduced, but the exhaust-pneumatic became the preferred tubular system, notably in England and the U.S. Refinements such as the WILLIS FLOATING LEVER improved the quickness of attack, but it did not achieve enough currency to sway those who still criticized tubular pneumatics for sluggishness. Nonetheless, the systems were put into new instruments well into the twentieth century and were often used to replace tracker systems in the early part of that century. Although electro-pneumatics have become the most common approach to rebuilding in all but the most "authentic" restorations, the difficulty of converting from pneumatic to nonpneumatic actions has led to the reconstruction of tubular-pneumatic actions, rather than replacement by tracker actions, in many instruments.

See also **Action**

RICHARD KASSEL

TUNING AND TEMPERAMENT

This entry explains the rudiments of tempered scales, describes the mainstream of historical types and specific schemes that are musically valid for special parts of the repertory, and discusses whether two different types, a MEANTONE TEMPERAMENT for Renaissance and early Baroque music and an irregular temperament for late Baroque music, can be provided on an eclectic organ with some extra pipes per octave in each rank, but with normal keyboards.

Tuning would seem to be a self-evident aspect of performing music, especially when instruments possess no flexibility as to pitch; once a set of organ pipes have been tuned, their notes will sound at a consistent pitch (assuming regular maintenance, proper winding, etc.). But until relatively recently (the nineteenth century), there were several ways of tuning relationships (intervals) between pitches, resulting in scales and chords that differed in quality, depending on their tonic (primary note). When polyphonic music began to use contrapuntal (linear, imitative) and harmonic (vertical, chord-based) textures, the notion of precisely tuned intervals was made difficult by two facts: (1) pitch theory was based on mathematically "pure intervals" (i.e., consonant fifths and thirds), and (2) if a twelve-note-per-octave scale was the norm, it was impossible to create an "equal" scale compatible with this pitch theory. Once keyboards became the norm in Western music, organbuilders were faced with the need to find a compromise, especially as musical style evolved through Renaissance modality to Baroque major and minor tonalities.

Monophonic (one-part) vocal music such as Christian chant could have been performed in just intonation, as the only tuning issues were linear (melodic), not vertical (harmonic). Fourteenth- and fifteenth-century tunings with pure fifths represent an early stage in the development of organ music, when it was not yet the concern of any great composer and when the keyboard had not yet become a vehicle for musical thought in general. Yet Pythagorean intonation (tuning by pure fifths) belongs to the historical mainstream of Western music as the medieval counterpart to the meantone temperaments of the Renaissance and early Baroque, the irregular temperaments of the late Baroque, and equal temperament in the nineteenth and twentieth centuries. Most organ music, however, would be ill-served by a tuning with pure fifths because of the consequences for the major and minor thirds.

The Need for Temperament

By definition, a "pure" consonant interval has a very simple frequency ration (3:2 for a fifth, 5:4 for a major third, etc.). When the two notes are heard together, there is no audible "beating" (pulsation) at the lowest unison between their partials (harmonic overtones). This beating is a periodic throbbing of intensity in an "impure" unison, where two waves reinforce and weaken each other at a rate equal to the difference between their frequencies. Beating more than about once per second may be impossible between pipes near each other on the same windchest, because the waves are likely to "lock into phase." Such slow beating would hardly be noticeable anyway, except between very long notes.

Beating between one and six times per second, sometimes described as "surging," is likely to be noticeable, but tolerable; around three beats per second is gently vibrato-like (as in the Vox Humana and Voix Celeste stops), as the rise and fall of intensity is clearly perceivable. Beating between six and twenty to twenty-five beats per second (depending on the psychoacoustic context), however, makes an unpleasantly "intermittent" effect; the intensity seems to change in a sudden, on-off way that disturbs the ear, much as strobe lights disturb the eye when they blink at similar rates. Beating faster than this is difficult to perceive and hence innocuous, just as blinking images of a movie are innocuous to the eye.

A tempered scale is one in which some or all of the consonant intervals (fifths and its inversions, fourths; thirds and their inversions, sixths) are intentionally tuned "impure" by some specific, slight amount. A useful definition here is "schisma" (skhisma), the difference between the two types of comma, or 1.95 cents. There are three reasons to temper scales:

(1) A chain of three pure major thirds (e.g., A-♭–C–E–G-♯) falls short of a pure octave by nearly a quarter-tone: 41 cents, or 21 schismas. This is because $(5:4)^3 = 125:64$, but $2:1 = 128:64$. (The cent, a logarithmic measurement, is 1/1200 octave, or 1/100 semitone.)

(2) A chain of four pure fifths (such as C–G–D–A–E) makes a major third (C–E) that is larger than pure by some 11 schismas, while in equal temperament, each major third is tempered larger than pure by 1/3 of the 21-schisma amount (7 schismas) and therefore beats about half again as fast (11/7, to be exact) as its counterpart in equal temperament. This 11-schisma (21.5 cents) discrepancy is called the syntonic comma.

(3) A chain (here a circle) of twelve pure fifths (such as A♭–E♭–B♭–F–C–G–D–A–E–B–F♯–C♯–G♯) does not produce a true unison or octave. G♯ is higher than the adjacent A♭; thus, G♯ – A♭ = 12 schismas (actually 12.01 schismas, or 23.45 cents, usually estimated at 1/9 of a whole tone). This is called the Pythagorean comma. The result that a "fifth" such as G♯–E♭ (actually a "diminished sixth") produces an interval far too sour to use as a fifth (the Wolf Fifth).

Meantone Temperaments

Tempering of consonant intervals in just (pure) intonation, Pythagorean intonation, equal temperament, and meantone temperaments is as follows:

With scales based on pure fifths producing undesirable beating thirds, organ tuners began, in the fifteenth

Temperament/ Intonation	**Fifths**	**Major Thirds**	**Major Sixths**	**Wolf Fifth**
Just (ratio)	702 (3:2)	386 (5:4)	814 (8:5)	no wolf
Pythagorean	0	21.5	21.5	-23.5
Equal	-2	14	16	no wolf
1/6-comma MT	-4	6	10	19.9
1/5-comma MT	-4.5	4.5	9	24
1/4-comma MT	-5.5	0	5.5	36
2/7-comma MT	-6	-3	3	44

Negative numbers = cents smaller than pure (untempered) intervals
Positive numbers = cents greater than pure intervals
MT = meantone

Fig. 75. Tempering of consonant intervals in just (pure) intonation, Pythagorean intonation, equal temperament, and meantone temperaments.

century, to temper (lower) the fifths in order to improve the thirds. The degree of tempering was based on the amount a chain of four pure fifths was larger than a pure major third, or 11 schismas (see reason 2, above). Fifths began to be tempered twice or more times as much as would later be done in equal temperament. In equal temperament, the amount is about 1 schisma per fifth, since 11 – 7 = 4 schismas (7.8 cents), to be distributed evenly among the four fifths in the chain; the resulting major third is about 14 cents higher than the pure major third. If the fifths are each tempered twice as much as in equal temperament, the resulting major third will be tempered by 11 – (4 x 2) = 3 schismas (5.85 cents above the pure major third; 1/6-comma meantone). If the fifths are tempered by 2.2 schismas (4.29 cents), the major third will be tempered by the same amount (since 11 ÷ 5 = 2.2, or 4.5 cents; 1/5-comma meantone). If, on the other hand, the fifths are tempered by one quarter of the syntonic comma (2.75 schismas = 5.36 cents), the major thirds will be pure; this is 1/4–comma meantone.

In all such "regular" temperaments (i.e., with uniform if not "pure" fifths), the whole tone—the difference between a fifth and a fourth—is exactly half the size of the major third; it has become the norm to call these "meantone" temperaments (although no one applies it to equal temperament, which fits this description). While some modern writers have reserved the term for the 1/4-comma scheme, those more historically in tune with Baroque theoretical usage apply the term *meantone* (*ton moyen*) to all tempering schemes shown here (except equal temperament). Evidence from the late fifteenth, sixteenth, and early seventeenth centuries shows that any shade of regular meantone or regular temperament with fifths uniformly smaller than pure by some amount between 1/6- and 2/7-comma is appropriate for that period's organ repertory. One may choose freely among these temperaments without going outside the limits of historical authenticity.

In choosing a temperament, one should remember that since the fifth is smaller than pure, but the major third usually larger than pure, the minor third (the difference between the two) is usually "squeezed" from both directions. The amount of its tempering downward will be the sum of the amounts for the fifth and major third (the negative of the amounts shown for its inversion, the major sixth, in the table). On the other hand, the smaller the major third, the lower, duller, and hence less effective the resolution of the leading tone (a major third above the dominant, moving up to the octave) will be. This consideration favors the schemes where the tempering of the major third approaches zero (note that all meantone temperament are better than equal temperament in this regard). One must find a compromise between the "vertical (harmonic) consonance" of 1/4-comma (or an intermediate shade) and "melodic euphony" of a scheme with the fifths tempered to a lesser degree (e.g., 1/6-comma).

In equal temperament, the standard for organ tuning at least since the time of Mendelssohn and Lizst, each major third is tempered larger than pure by one-third of 21 schismas, or 7 schismas (see reason 1 above). Therefore, the major thirds and tenths (octave plus major third) most commonly used (in mid-keyboard) beat intermittently. The rates of beating are generally calculated for modern performance pitch (a' = 440Hz). The beating of some old French organs (pitched at a' = 390Hz) would in fact be around 10 percent less under equal temperament, but that is not enough to eliminate the basic phenomenon. The intermittent beating of its thirds was undoubtedly the reason why most Renaissance and Baroque organists and organ makers regarded equal temperament as "dissonant" and would not use it.

In equal temperament the 12 schismas of this comma are distributed evenly around a "circle" of twelve fifths, which are thereby each rendered smaller than pure by one schisma. Since the fifths in any meantone temperament are smaller than pure by at least twice this amount, no meantone temperament can have a circle of twelve fifths. On the other hand, the inclusion of thirteen or more sets of pipes per octave, with split keys for G♯/A♭ and/or D♯/E♭, was a deluxe (but not abnormal) feature of Renaissance and early Baroque organs. In the repertory from that time, D♯s and A♭ are fairly common, whereas A♯ and D♭ are rare. So a Renaissance- or early Baroque-style organ today should have these extra pipes and split keys, at least on one manual.

Irregular Temperaments

To avoid split keys without giving up altogether the euphonious triads of a meantone temperament, many late-seventeenth- and eighteenth- century organs were tuned in "irregular temperament" (i.e., with slightly different sizes of fifth within the same scheme). These tunings usually provide a circle of fifths, but instead of being tempered all alike, the fifths among the diatonic notes were tuned smaller, on average, than those among the chromatic notes, so that the major thirds among the diatonic notes would beat distinctly less (i.e., would be larger) than in equal temperament. This meant that some of the major thirds involving chromatic notes were tuned smaller on average, than those among the diatonic notes. The major and minor triads and scales thus had different nuances of intonation, and early-eighteenth-century music theorists never tired of praising this nuance of what the French called *tempérament ordinaire* (or *temperament commune*) and the Germans called *gute Temperatur*. A stylistic distinction can be made between a *tempérament ordinaire*, best suited to French classical organ repertory, and an irregular *gute Temperatur*, best suited to Johann Sebastian Bach's music. (Although some German theorists considered equal temperament a *gute Temperatur*, if not necessarily the best one, it was practically never used on the organ until after Bach's lifetime.)

Given the differences between these two irregular temperaments, the problem of finding a middle course between the French and German, for an "eclectic late Baroque" organ, can be clearly understood. One result of the different systems is that the scales and triads in the French approach were more varied than the German system. Another significant distinction is while the Germans would tune each fifth either pure or smaller than pure (limiting the tempering of the third to a maximum of 11 schismas), the French would tune the fifths E♭–B♭–F, and perhaps A♭–E♭ as well, slightly larger than pure. Thus ♭ (and their enharmonic twins, the sharps) would be lower in the French temperament than in the German; the difference would become more pronounced for each successive flat in the chain B♭–E♭–A♭. The effect can be illustrated by fact that the C-minor scale, already comparatively "dark" in German temperament (when compared to the more traditional D minor), was even more so in the French because of its lower flats and leading-tone (B♮). In the German system, however, the intervals would be slightly larger than in equal temperament. French keyboard composers used E-major triads in a way that relied implicitly on these qualities, not least in their church music (e.g. their settings of the *Cuntipotens genitor Deus Gloria*).

The problem of finding a good compromise between these two styles of late Baroque tuning can be illustrated with the chain of thirds, A♭–C–E–G-♮. For the sake of the French music, one wants to prevent the intervals from beating intermittently; but one also wants to prevent the A♭–major triad (in Bach's "St. Anne" organ prelude, for instance) from sounding harsh. However, the beating of E–G♯ can be reduced by some five to ten percent, and thus brought down to the borderline of intermittence when the interval is tempered by 7 schismas, if the instrument is tuned at Baroque pitch such as a' = 410Hz or 390Hz instead of today's 440Hz. Hence this figure may represent part of a sensible compromise between the late Baroque French and German styles of tuning.

With careful reckoning and musical probing it may be possible to design an "eclectic Baroque" tuning whose diatonic notes can serve also in a regular meantone tuning for Renaissance music. If in such a tuning A–C♯ is to be tempered less than E–G♯, then the third D♭–F–A–C♯ must be tempered by some 12, 3, and 6 schismas respectively (for a total of 21). One has to judge by ear whether D♭–F when so heavily tempered will sound harsh in Bach's music. A sensible distribution of schismas for E♭–G–B–D♯ would be 9-3-9 or 8-3-10; for B♭–D–F♯–A♯, 5-5-11 or 6-4-11.

As has been shown, late Baroque organ music would be ill-served by a tuning with one or more pure major thirds. Contemporary theorists were explicit about this. Most of the German theorists mention (Werckmeister 1681, 1698; Neidhardt; Sorge) that in any "good" temperament C-E must beat. The French theorists around 1700 (Loulié, 1698; Sauveur, 1701) wrote or implied that C-E was normally tuned larger then pure by 1/5 comma. Although Rameau wrote in 1726 that the fifths C–G–D–A–E must be tempered by 1/4 comma because the major third would, unlike a fifth, lose its vibrancy if tempered (*ne frémit plus*), in 1737 he abandoned this doctrine, stating that the diatonic fifths in *tempérament ordinaire* were tempered by an amount "rather near to" 1/4 comma (*diminuées d'à peu près un quart de Comma*).

Apart from the problems of historical research and theoretical calculation, setting a given temperament precisely can be such an exacting task that, on an organ where the pipes are difficult to reach, one may despair of achieving any elegant tuning and settle instead for a rough scheme. Thus Werckmeister, while acknowledging that in his tuning C-sharp was higher than it ought to be, nonetheless raised it because one could convert it from 1/4-comma meantone temperament by retuning only some of the notes. (This can be done by tuning the fifths A–E–B and C–F–B♭–E♭–A♭–D♭–G♭ purely, and checking that F–F♯ beats no faster than C–G). The cumulative discrepancy of a schisma between the syntonic and Pythagorean commas, of which Werckmeister was unaware, can be absorbed by "drawing" in some of these pure-sounding fifths. One has to tune more precisely, however, to get a temperament which will really suit at once the music of Bach and Nicolas de Grigny. In general, with tuning as with voicing and scaling, such precision will distinguish a beautiful organ from one that is merely loud and colorful.

See also **Pitch and Pitch Standards**

MARK LINDLEY

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TUNING FORK

A hand-sized metal fork with two long thin tines which, when struck, produces a fundamental "standard" pitch to which instruments may tune. Especially helpful is its almost complete insensivity to temperature change, hence constancy of pitch. NICKING may be used to sharpen or flatten pitch subtly. Its invention in the early eighteenth century indicates that earlier organbuilders used other means to standardize pitch; pipes of a certain dimension produced pitches that individual builders used to tune their instruments. In 1619 Michael PRAETORIUS proposed the organ pipe a' = 424 as a standard; the tuning pitch rose through the nineteenth century to the twentieth century's a' = 440 standard. Devices like the chromatic stroboscope (mid-twentieth century) use electronics to produce greater precision and duration in the tuning process; they also permit tuning of individual scale notes using Hz or cents, although organ pipe tuners ultimately depend on their ears for fine tuning, much like their predecessors.

See also **Pitch and Pitch Standards; Tuning and Temperament**

RICHARD KASSEL

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Concert "A" Pitch Since 1511. <http://www.spiritsound.com/pitch.html>.

TWELFTH/NASARD/NAZARD/NASAT/QUINT

An open metal mutation stop at 2-2/3' in the manuals and 5-1/3' in the pedal, producing the third partial (above 4' and 16', respectively); usually part of a Diapason or Principal chorus, it enriches the harmonic content of its unison rank when applied. It is often called a Nasard or Nasat; the Nasard is usually a Flute of various constructions, while the Nasat is a hybrid Flute-Principal, with a conical shape that reduces loudness and brightness. In older instruments the pitch designation is frequently given as 3'.

See also **Stop**

TWENTY-FIRST/SEPTIÈME

A soft, open metal mutation stop producing a note two octaves and a "flatted" seventh—that is, the untempered seventh partial, above the unison; it is pitched most often at 1-1/7' in the manual or 2-2/7' in the pedal (above 8' and 16', respectively). An eighteenth-century stop popularized by Aristide Cavaillé-Coll, it anachronistically found its way onto neobaroque instruments after World War II.

See also **Stop**

TWENTY-THIRD

See None/Twenty-Third

U

UNDA MARIS

(*Lat.*, ocean or sea wave.) Originally and properly a soft, slow-beating Celeste stop made from one or two open or stopped Flute ranks, the name has also been used for both sharp and flat Celestes made from a variety of stops, both flutes and strings. Gottfried Silbermann made it of pipes of Diapason scale, intending it to be used with the 8’ Principal. Some French builders used the Quintaton, and Norman and Beard used two Zauberflöte ranks, one tuned sharp and one tuned flat. Ernest M. Skinner’s Unda Maris used Dulciana ranks, which he considered a string, were tuned sharp like all of his Celestes.
See also **Stop**

Edward L. Stauff

UNIFICATION

A system of duplexing and transmission of stops; the principle behind the form of extension organ developed by Robert Hope-Jones, and which he called the *unit orchestra*.
See also **Unit Organ**

UNIT CHEST

A synonym for George A. Audsley’s “unit action” (1905) or the later extension organ, referring to a system by which a single rank may be played at other ranks (“borrowing” or “transmission”) or in which a rank can accessed by more than one keyboard or pedalboard (“duplicating” or “communication”). Robert Hope-Jones developed an electro-pneumatic system he called “unification” in the 1890s, before coming to the United States. He and the Wurlitzer Company developed the Wurlitzer Hope-Jones Unit Orchestra; he sold his patents to Wurlitzer shortly before his death. Other chests used direct electric actions with solenoids, including those developed by Kilgen, Link Orgelbau, and Wicks. At its most sophisticated, the unit chest put an individual electromagnetic chest for each pipe, allowing it to be played by any key on any manual; this saved money by reducing the number of pipes and used space more economically. But the increased cost of building and maintaining individual pipechests plus issues of voicing, tuning, and cancellation offset the plusses to a degree. Eventually these difficulties were resolved by multiplex electronics; the tradeoff was, of course, the lost sound of real pipes, however well MIDI (musical instrument digital interface) sampling might work.
See also **Unit Organ**

Richard Kassel

UNITED KINGDOM

See England

UNITED STATES OF AMERICA

During their colonial periods, the three largest countries in North America—Canada, Mexico, and the United States of America—began to import European organs to meet the musical needs of those congregations that allowed instruments into their houses of worship. In the United States, Roman Catholic missionaries brought small instruments into the northern portion of Nueva España (present-day New Mexico) as early as the seventeenth century. This pattern continued into the mid-nineteenth century (California), when the Treaty of Guadelupe Hidalgo settled the American-Mexican territorial dispute in 1848 (completed by the Gasden Purchase of 1854). The (mostly) westward expansion of the United States from the original thirteen colonies (belatedly labeled "manifest destiny") had reached the Pacific Ocean; the organ followed this geographical trend as new communities were established (or old ones reconstituted) throughout the western United States. But the story of the American organ, like the country's history, begins on the East Coast.

The Colonies and Early Nationhood

The first British colony was attempted in the sixteenth century, but the first successful colonies were started in the seventeenth century. These colonies were often populated by immigrants whose Calvinist-based faiths insisted on the sanctity of the spoken voice to the exclusion of all music. The first such sect to arrive, the Pilgrims of Massachusetts, were English Separatists who emigrated first to the Netherlands and then the New World. The English Puritans (later known as Congregationalists) were the first significant Protestant sect to settle in the Americas, especially after the monarchist Restoration of 1666. Other Calvinist groups, notably Presbyterian and Reformed Churches, allowed limited singing in the form of the metrical psalm. The non-Calvinist Society of Friends, or Quakers, did not use music in their services, or "meetings"; but the end result of its members' emigration was William Penn's colony in 1681, where religious tolerance was standard policy. So it was in eighteenth-century Pennsylvania that the first significant organbuilders worked in colonial America; only Boston produced anyone comparable.

Other Protestant churches, as well as the Catholics, brought with them an enthusiastic use of instruments during worship, especially the organ—whether to support congregation singing, provide background music for ritual purposes, or perform solo for the beginnings and ends of services (and, in some cases, during them). The state-supported Anglican (later, American Episcopalian) church had borrowed the splendor of the Roman rite, found simultaneously in Catholic Maryland. Another sixteenth-century Protestant church, the Lutheran (or Evangelical), raised the vernacular chorale to an exalted place in the service, while the chorale prelude became one of the organ's great repertoires.

English Organs in the Colonies

For the most part, organs in New England, the mid-Atlantic region, and farther south came from England. (The oldest known instrument in the United States, a 1630 English chamber organ in St. Luke's Church, Smithfield, Virginia, was not imported until much later.) The first instrument (anon., 1/6) was imported by Thomas Brattle to Boston (ca. 1708). When Brattle died in 1713, his will stipulated that it be offered to Boston's non-Anglican Brattle Square Church, which not surprisingly rejected it. His second choice, the King's Chapel (Anglican) in Boston, accepted and installed the organ in 1714. It was moved twice more: to Newburyport, Massachusetts, St. Paul's (1756) and Portsmouth, New Hampshire, St. John's (1836; rest. Fisk, 1963). That the so-called Brattle organ has survived some three centuries is well-nigh miraculous, considering the more typical pattern: congregational upward mobility (and desire for a "better," i.e., bigger organ), unplayability due to poor maintenance or loss in a fire or other acts of nature or humanity, and replacement of the organ.

Other imports for Anglican churches came from well-known British builders, among them the German-born John SNETZLER, who became one of England's greatest eighteenth-century builders; one instrument, imported to Massachusetts (1762, orig. 1/10, no ped) is now in South Dennis, Massachusetts, Congregational Church (rest. Andover, 1975); other Snetzlers also went to Connecticut and South Carolina (Charleston, St. Michael's, 1768). Others included Richard Bridge (d. 1758), whose 1756 instrument for Boston, King's Chapel, replaced the Brattle organ; Henry Holland (1745–1806), for New Haven, Connecticut, Trinity Church (1784); Samuel GREEN, for Boston, Brattle Street Church, (1790); Astor and Company, now in Boston, Old State House (ca. 1788, 1/30); and John Avery (1738–1808), for Salem, Massachusetts, First Church (1800). New York City had a few important British instruments as well. Snetzler built an organ (1764–65, 3/18, no ped) for Trinity Church (repl. 1741 J. G. Klemm organ), but it was destroyed by fire in 1776, replaced belatedly by a new Henry Holland (1791, 3/18, no ped). There were also British instruments in Baltimore (two by George Pike ENGLAND) and Charleston, South Carolina (Snetzler, St. Michael's; facade survives).

The Pennsylvania "Dutch": America's First Organ Builders

The first significant school of eighteenth-century American organ building was the German-American school, based in eastern Pennsylvania. Lutheran and other congregations were importing organs (Philadelphia, St. Michael's, J. A. Schmahl, 1751), but a group of immigrants were already at work. Johann Gottlob Klemm came from Dresden via the Moravian community of Herrnhut, in Saxony, to the United States in 1733. After building the Trinity Church organ in New York City (1739–41), Klemm returned to Pennsylvania, repairing or building instruments in the Bethlehem area. After a second sojourn in New York (1746–57), he returned to Bethlehem. In 1757–58, he went to build an organ in nearby Nazareth; he was accompanied by David Tannenberg. The two built two instruments for Nazareth Hall and other locations before Klemm's death in 1762.

Tannenberg became the most important German-American builder of the eighteenth century; his career ended only with his death after a fall in 1804. Another Saxon Moravian, he arrived in Bethlehem in 1749. After sojourns in Nazareth and Bethlehem (again), Tannenberg moved in 1765 to Lititz, Pennsylvania. Besides participating actively in community life, he built organs for Moravian and other denominations, including Reformed (Lancaster, Pennsylvania, 1770), Lutheran (Lancaster, 1774), and Roman Catholic (St. Mary's, Lancaster, 1775). He built one- and two-manual organs; his only three-manual instrument, for Zion Lutheran Church, Philadelphia (1790, 3/34, lost), received a state-sponsored dedication and was debuted before President George Washington and other dignitaries. Tannenberg also built instruments for churches in Maryland, North Carolina (Salem, playable), and Virginia (Madison, playable). His surviving playable instruments possess—not surprisingly—a German Baroque sound; but extant specifications show he included relatively few reeds, typical of eighteenth-century Anglo-American organs. Tannenberg's contemporaries thought highly of his instruments; the resulting stream of work made it necessary for him to have the help of Johann Philipp Bachmann (1762–1837), a Thuringian who came to Tannenberg in 1793 via Herrnhut. In the organbuilder tradition, Bachmann married Tannenberg's daughter, Anna Maria; he continued working with his father-in-law, despite his wife's suicide (1799). Bachmann continued to build Tannenberg-influenced organs tuntil 1821, when he turned to piano and cabinetry.

There were other Pennsylvania builders of importance. Philip Feyring, a German Lutheran, worked in Philadelphia from the mid-1750s on. He is best known for organs built for three Episcopalian churches there; only the case of his instrument at Christ Church survives (1766; 3/27; incorp. H. Erben, 1836; extant). The Dieffenbach family were Pennsylvania Dutch builders active for four generations (1776–1900); they worked in Millersburg (now Bethel) and installed instruments throughout eastern Pennsylvania, such as the organ in Rehrersburg (near Bethel), Altalaha Lutheran (1816; 1/12, pull-down; rest. Thomas Eader, 1973). The Krauss family was among a group of Schwenkfelders (dissident Lutherans of Silesian origin) who immigrated to Pennsylvania in 1734, eventually residing in Upper Hanover, Pennsylvania. Although the Schwenkfelders did not use organs in church, second-generation American brothers John Krauss (1770–1819) and Andrew Krauss (1771–1841) began building organs in 1796 for churches that did, such as Goshenhoppen (now Bally), Pennsylvania, Most Blessed Sacrament (1799; 1/10; rest. Hartman and Beaty, 1962). After John's retirement in 1812, Andrew and two more generations of Krausses built organs into the twentieth century (Old Norriton, Pennsylvania, Presbyterian Church, 1850; 1/6; extant). John left an important diary that documented his work with Andrew (and beyond); he also made a copy of the same Georg Andreas Sorge treatise known to Tannenberg, who knew the Krausses and one of whose sons worked for them (1798).

New England Contemporaries

The German-American school produced the best U.S. instruments of the eighteenth century, but its influence was limited outside Pennsylvania. The New England school of the same period, while less active at first, sowed the seeds for a large number of important builders to come to the United States. Bostonian Edward Broomfield, Jr. (1723–1746), built the first organ by a native-born American (Boston, Old South Church), based solely on his study of imported English instruments; during the Revolutionary era, it was removed for safekeeping but later destroyed by fire. The first Bostonian professional builder, Thomas Johnston, was an engraver, ornamental craftsperson, and singer who built a small number of instruments, including one for the city's Old North (Christ) Church (1759; 2/11; case in W. M. Goodrich reb., 1820; extant). Josiah Leavitt, who watched Johnston at work, began building organs in 1786 in Sterling, Massachusetts; after residing in Hingham, Maine, for a time, he moved to Boston, where he advertised his services as early as 1793. Significantly, Leavitt built an instrument for Newburyport, Massachusetts, First Congregational (1794; 1/8); a Congregationalist himself, Leavitt had installed an organ for a denomination that had previously rejected the use of instruments. Another Congregationalist, Henry Pratt (1771–1841) of Winchester, New Hampshire, was a house joiner whose crafting skills were prodigious and various; he limited himself to one-manual instruments for church or residences. His first instrument (1798, residence) borrowed scaling information from Leavitt's collaborator Eli Bruce (1767–1839); the instrument eventually went to the Winchester Public Library (1903). Pratt installed organs throughout New England and New York. One of his later instruments now stands at Old Sturbridge Village, Massachusetts (ca. 1830; 1/5; rest. Andover, 1994).

The Nineteenth Century: before "Romanticism"

As the new century began, New York, and especially its eponymous city, joined New England and Pennsylvania as organ-building centers. The city's first significant builder was the German-born John GEIB, who worked in London before establishing Geib and Sons in the United States (ca. 1798). He applied factory principles to his instrument building, producing instruments in unprecedented numbers. Geib's first American-built organ was for the New York City, German Christ Lutheran Church (1798–99; 2/13); others included New York City, Ann Street (Christ's) Church (1800–02; 2/16, pull-down; destr. 1834), and several locations in New England. No Geib organs survive, and his sons remained builders for only a brief time, but he proved that building organs in New York was a viable occupation, and the city would see many builders in the century to come.

The Goodrich Dynasty (and Others)

In New England, the time-honored idea of teacher/apprentice-driven instrument building dynasties began to assert itself. Leavitt and Pratt's collaborator, Eli Bruce, built a one-manual, four-stop organ at his home in Templeton, Massachusetts. During the project, he was visited by William M. GOODRICH, who then gathered organ-building skills in New Hampshire and Boston (1798–1804). William formed a partnership with his brother Ebenezer (1782–1841) in Boston; one of their organs was divided between two sides of a gallery (Cambridgeport, Massachusetts, Unitarian Church, 1805–06), probably the first of its kind in the United States. The Goodrichs dissolved their partnership in 1807; Ebenezer moved to Cambridgeport and concentrated on smaller instruments. William, on the other hand, continued to build on a larger scale. He was joined by Thomas APPLETON, who became his brother-in-law during this time (1807–11). Goodrich became a traveling exhibitor of Johann Nepomuk Maelzel's "Pan Harmonicon" for a year, then returned to Boston; he worked off and on with Appleton (Phillipston, Massachusetts, Congregational Church, 1812) in different partnerships until 1820, when he went out on his own.

Goodrich not only studied François BÉDOS DE CELLES's 1766 treatise *L'art du facteur d'orgues* and English pipe scaling, but also examined imported organs throughout Boston. He eventually built around fifty instruments (including thirty-eight church organs) and repaired or restored many others. He was especially proud of the organ for Boston, St. Paul's (1826–27; 3/26). He experimented with concussion bellows, pipes capable of more than one single pitch, and treble swell boxes. One Goodrich instrument survives in its original site: Nantucket, Massachusetts, Unitarian Church (formerly Second Congregational, 1831; 2/31; rest. Andover, 1966). Appleton also went into business on his own after 1820 (except for a partnership with Thomas D. Warren, 1847–50). Initially, he employed both Goodrichs and the London-born Henry CORRIE as voicers, but eventually he took on the job himself. Appleton, who mainly built church organs, split his output fairly evenly between single-manual (Charleston, South Carolina, St. Philip's, 1839; 1/7; ped added later; extant) and two- and three-manual instruments (Worcester, Massachusetts, College of the Holy Cross, 1840; 3/18; rest. Owen and Tattershall; orig. for Boston, Perkins School for the Blind).

William Goodrich took on apprentices who later contributed significantly to the New England building scene. The founders of HOOK AND HOOK, the brothers Elias and George Greenleaf Hook, started working for Goodrich in 1824. Returning to their hometown of Salem, Massachusetts, they opened a workshop in 1827; their first instrument (ca. 1827; 1/6) survives at the Essex Institute there. Moving to Boston in 1831, the Hook and Hook firm built primarily for Massachusetts locations during the production of its first one hundred organs (1831–49), including Boston, Tremont Temple (1845; 3/34; the city's largest organ; destr. 1852). The production of the next one hundred organs came more quickly (1849–56); by 1853, Hook and Hook was the largest organ manufacturer in the United States. The firm built an even larger replacement for the Tremont Temple (1854; 4/54). By 1859, the firm was producing instruments for places as far away as Alabama, Ohio, and Tennessee. Hook and Hook produced the first American organ with a radiating concave pedalboard (Providence, Rhode Island, First Baptist; 1857; twenty-nine-note pedal; case survives). The mellow "English" registration of the organ in Jamaica Plain, Massachusetts, First Unitarian (1854; orig. 3/35; extant) is more akin to a large Goodrich or Appleton, rather than a "Romantic" instrument; but the decreased use of nonoctave (ALIQUOT) stops—a single Twelfth (2-2/3') on the Great—suggests a trend that would dominate by the end of the century.

Other Goodrich apprentices included the Stevens brothers, George (1803–1894) and William (1808–1896). Originally from Norway, Maine, the Stevens went their separate ways after their apprenticeship. Each had collaborators for brief periods; William Gayetty and George Stevens took over Goodrich's business in 1833, but the partnership lasted only two years. George Stevens, who served as mayor of Cambridge, Massachusetts, in the early 1850s, was the better known, building over eight hundred instruments (fewer than seventy-five survive). He built mostly one- and two-manual organs for small churches, including Blue Hill, Maine, First Baptist (ca. 1867; 1/9; rest. Andover, 1975).

The Goodrich dynasty of New England builders continued to evolve. William Allen JOHNSON, who helped install a Hook and Hook organ in 1843, started his own firm in Westfield, Massachusetts (1847); a large number of playable Johnson instruments in the region survive. The Johnson Organ Company (later Johnson and Son) built over 850 instruments; although Johnson made only mechanical action (tracker) organs throughout his career, he began applying BARKER LEVERS to larger instruments around 1872. His son, William H. Johnson, entered the firm in 1871, taking it over in 1890, but its last instrument was built in 1898 (Chicago, St. Paul's Lutheran, 3/44; used until 1955).

After working for Appleton, William B. D. SIMMONS went into business for himself, associating with three different partners over a fifteen-year span (1845–60); thereafter, his firm was known as W. B. D. Simmons and Company. Although the proportions of some Simmons manuals and pedalboards made them difficult to play, he also experimented with Barker levers, couplers, nonbreaking independent stops, and divided-stop combinations. During his collaboration with the organist John Henry Willcox (1827–1875), Simmons built a German-influenced instrument for Cambridge, Harvard University, Appleton Chapel (1859; 3/9); many of his two-manual tracker instruments have been restored.

An independent builder, Joseph ALLEY of Newburyport is best known for the organ that replaced the 1794 Leavitt at the Newburyport First Religious Society (1834; 2/31; reb. G. S. Hutchings, 1889; reb. Andover, 1957; electric). He also collaborated with Henry Ward Poole (1826–1890) on two justly tuned organs (1849–51).

During this time, parlor organs were immensely popular, found in small churches or bought by private individuals who could afford them. Ebenezer Goodrich, HOLBROOK AND WARE, William A. Johnson (early in his career), Pratt, and the Stevens brothers were active from 1837–50; the Holbrook and Ware firm was taken over by G. H. Holbrook's son Edwin, and continued until the 1890s. There were also groups of parlor organbuilders centered on the New Hampshire towns of Mount Vernon (following an older German-American style) and Winchester/Keene (in a more Bostonian style) in the 1830s and '40s.

New York and Henry Erben

New York, a late entrant in the organ-building industry, blossomed in the nineteenth century; rather than Geib, Thomas S. HALL led the way. Having moved from England to Philadelphia, he remained there, except for an interval in 1812–13, when he installed an organ by John LOWE (New York, St. John's Chapel, 1812–13). In 1817, he opened a shop in New York City. Hall worked the market south of the Mason-Dixon Line, supplying an impressive instrument to Baltimore's Cathedral (ca. 1820; 3/35; largest American organ). He built instruments for churches in New York City and Poughkeepsie, New York. Henry ERBEN, whose sister Maria married Hall, was a New Yorker whose father, Peter (1771–1863), also a builder, had moved from Philadelphia to become a leading church organist. Henry Erben first apprenticed with Hall in the late 1810s, becoming his partner during the 1820s (New York, Market Street Dutch Reformed [now First Chinese Presbyterian], 1824; 1/7; reb. Erben, 1841; 2/12; in use until 1992). Hall disappears from the records in 1827, resurfacing in 1846, when he began collaborating with John Labagh (1810–1892). This partnership produced instruments in Philadelphia and New York, including one at the latter's Fourteenth Street Presbyterian (1851; 3/22, double pedalboard); another prophetic instrument, its registration eliminated mixtures, aliquots, and strong reeds from the Great, reserving them for the Swell (including a Sesquialtra [*sic*], allegedly its first American use), which had a "double box" (two sets of shutters) for an especially dramatic crescendo and decrescendo. James Kemp eventually joined Hall and Labagh, and the firm continued as Labagh and Kemp after Hall's death until 1892.

After dissolving his partnership with Hall, Erben set up his own firm. He became one of the leading organbuilders in nineteenth-century America, building or installing over seventeen hundred instruments, including nearly 150 instruments in New York alone. Although the son of a German-American builder, Erben's instruments resembled those of the New England (i.e., neo-British) builders. He was the first truly national builder, his instruments traveling as far northeast as Maine, as far south as Florida and Louisiana, to the Midwest and Great Lakes states, and as far west as San Francisco; at least twelve instruments went to churches in Richmond, Virginia. Erben's skill as a tracker action builder was matched by "displays of artistic temperament" (see Ochse) that were as much about business and egotism as they were genuine eccentricity. Erben built one-, two-, and three-manual organs: Sheldon, Vermont, Grace Episcopal (1833; 1/9, pull-down; rest. Smith and Moore, 2001); Charleston, South Carolina, Huguenot Church (1845; 2/15/pull-down, one aliquot, no mixtures; rest. Knowlton, 1997); and New York, Old St. Patrick's Cathedral (1868; 3/46; in use). His best-known instrument was New York, Trinity Church (Episcopal, 1846; 3/30); after alterations by, among others, Skinner and ÆOLIAN-SKINNER/CASAVANT FRÈRES, all traces of the original had been removed. (The instrument was rendered unplayable by the fallout from the September 11, 2001, attack on lower Manhattan.) Erben continued building in an increasingly conservative style after the Civil War; his firm dissolved soon after his death.

Erben's primary competitor, George JARDINE, was a British organbuilder who emigrated to the United States in 1837. Intending to build barrel organs for small churches and fairgrounds, he found the market insufficient and switched to keyboard organs. Among his surviving instruments are Mobile, Alabama, Cathedral of the Immaculate Conception (1858; 3/38) and Augusta, Georgia, Church of the Most Holy Trinity (1868; 2/27). His famous instrument at New York, St. George's (1867–69; 4/50) has been lost; typically, it featured intricately painted pipes and radiating Tubas en chamade. Jardine began as a mainstream organbuilder, but his familiarity with contemporary French organs inspired several innovations to American instruments: combination movements, reversibles, and couplers; "pneumatic and vacuum pallets"; vertical swell blinds; keys with overhanging playing surfaces and diagonal, stepwise drawstops; radiating concave pedalboards; and reversed bellows ribs. He may also have introduced a number of stops as well as equal temperament, although Simmons is also given credit for the latter. Even so, his grandson, Edward D. Jardine, who joined the firm in 1860, still showed a preference for tracker actions in organs "of ordinary size and straightforward construction." In 1895, the firm rebuilt its own 1886 instrument at New York, St. Mary the Virgin, with two consoles; each had three (formerly two) manuals, pedal, electro-pneumatic action, and electrically operated swell box. The organ was well received, but technical problems came quickly, and an Æolian-Skinner replaced it in 1932. After George's retirement in 1874, the company continued until its amalgamation by other firms (1899).

Richard M. FERRIS was an apprentice with Hall and Erben who had a workshop from 1840. He entered into partnership with his half-brother Levi Underwood Stuart in 1857 and helped finish an organ by Thomas ROBJOHN just before Ferris's death. Ferris is best known for an instrument built for New York, Calvary Episcopal (1847; 3/32; reb. 1868, 1888; rest. Andover, 1976; now 3/36), which was bought by the Round Lake Association in Malta, New York, and moved there in 1888. It is usually considered the oldest three-manual American organ close to its original specifications.

Eastern Roots, Midwest Arrivals

Two pioneering firms in the westward movement of organ manufacturing started in New York. Henry PILCHER came to New York from Dover, England, in 1832. For the next two decades, he divided his time among New York City; Newark, New Jersey; and New Haven, Connecticut; he worked for Erben in the 1840s. In 1852 he moved to St. Louis, Missouri, by which time his firm, Henry Pilcher and Sons, involved his sons Henry Jr. and William. In 1858, Henry retired, and the firm continued under his sons, who moved it to Chicago in 1862. Their factory was destroyed in the 1871 Chicago Fire, and the renamed Henry Pilcher's Sons relocated to Louisville, Kentucky. During its years in the Midwest, Pilcher supplied numerous instruments throughout the South, although its best years began with the move to Louisville. The firm continued until its purchase by M. P. MOLLER in 1944.

The other major Midwestern firm with New York origins was started by George KILGEN, whose ancestors were French Huguenots who escaped to the Karlsruhe area of Germany and began building organs there in the 1640s. Kilgen started his New York shop in 1851; twenty-two years later, he moved his family and operation to St. Louis (New Memphis, IL, St. Peter's Evangelical Lutheran; 1874; repl. 1948). His son Charles joined the firm in 1885; renamed George Kilgen and Son, the firm survived in various incarnations until 1960. Kilgen built some large instruments, but was best known for two-manual and pedal organs of around eleven stops. In the 1920s, the company added theater organs to its output.

Other important nineteenth-century northeastern firms had their beginnings outside the New York–New England region. Two of Pennsylvania's Moravian organ-building families, Krauss and Dieffenbach, continued their work, but their instruments remained small and had little influence. The new group of Pennsylvania builders was led by the English-born John C. B. STANDBRIDGE, who played a new Erben as organist at Philadelphia's Christ Church (1837; 3/32). He began building three years later; among his accomplishments was one of the first four-manual instruments in Philadelphia (St. Clement's, 1854). Upstate New York State was blessed with the skillful work of the Alvinza ANDREWS family; Garret HOUSE, who worked in Buffalo (Trumansburg, New York, First Presbyterian, 1860; 2/16); and John G. MARKLOVE and his successor Clarence E. Morey (in business until 1940). All three firms built instruments for the Midwest as well as for their local market.

Builders of German origin who worked outside of the northeast included Henry Berger, whose relatively brief career included sojourns in Baltimore, Ohio, and Pennsylvania. August POMPLITZ began building in the

1840s, becoming Baltimore's most important organ maker after the Civil War (St. Gregory's, 1875; 2/26). The firm continued under Pomplitz's sons for a decade after his death. Mathias Schwab (d. 1864) started a firm in Cincinnati in 1831. Two of his most important instruments were built for Roman Catholic archdiocesan churches: St. Louis, Cathedral (1838; 2/27) and Cincinnati, Cathedral of St. Peter in Chains (1846, 3/44; hydraulic blower added, 1891; repl. by Farrand and Votey, 1899).

For the domestic market, the parlor organ was replaced by the REED ORGAN. The "American organ" (as this type was known in Europe) used the "suction" or exhaust principle (first patented 1812), a relatively direct approach (not unlike the Renaissance pipe organ) and equally incapable of expression. This foot treadle–operated, free-reed instrument became the most popular home keyboard in this era, less expensive than a piano and easier to manufacture. It reached its greatest popularity toward the end of the nineteenth century, manufactured by more than two hundred firms, including ESTEY, FARRAND AND VOTEY, W. W. KIMBALL, MASON AND HAMLIN, SMITH AMERICAN, and Story and Clark.

"Romanticism": an Irresistible Force

In 1863, the Boston Music Hall held its inaugural concert for its new organ. Although the case was American, the instrument was made by the German E. F. WALCKER (1857–63; 4/68, hydraulic blower). The hall's president chose Walcker after a European fact-finding tour, apparently never considering the commission of a U.S. company, including Boston's most famous firm, Hook and Hook. The Walcker organ brought new elements to American shores: a large Pedal division of twenty stops (divided into Forte and Piano) with a thirty-note compass, Barker lever, balanced swell pedal, and unusual stops, including free reeds (e.g., Choir Physharmonica) and compound Bifara and Piffaro. This instrument's celebrity was relatively brief; complaints about voicing and slow speech, combined with the arrival of the Boston Symphony Orchestra to the hall, led to the organ's sale in 1884. In a notorious 1897 auction, the $60,000 organ was saved by a sole bidder from the Methuen (Massachusetts) Organ Company for the sum of $1,500. The purchaser, Edward F. Searles (1841–1920), designed and built the Serlo Organ Hall for it; the process of removal and renovation was completed in 1909 by the Methuen Organ Company. Privately used until Searles's death, it was rebuilt in 1946–47 by G. Donald HARRISON, who expanded the instrument to 112 ranks, replaced the reeds and pneumatics, enlarged the Pedal division, lowered the wind pressure, reduced the amount of enclosure, and eliminated extension and borrowing—thereby thrusting a moribund mid-nineteenth-century organ into the twentieth century and playability.

By then, the 1863 Walcker had cast a wide shadow over American organ building. The nineteenth-century tidal wave of American musicians to study in Europe included leading organists from New England and elsewhere. Organbuilders such as Hilborne L. ROOSEVELT AND Jardine traveled to Europe to learn from Aristide CAVAILLÉ-COLL and others; Hilborne and his brother Frank Roosevelt (1862–1895) brought many European innovations to American organ making. The Hook and Hook firm, smarting from the Music Hall decision, began building larger instruments in greater numbers. One of its last tracker instruments was installed in Worcester, Massachusetts, Mechanics' Hall (1864; 4/52; rest. Noack, 1982); an 1866 Hook and Hook was the first American organ to use tubular-pneumatic action. In 1870, Frank C. Hastings, who had joined the company in 1855, became a partner of what became Hook and Hastings; by 1881, he was sole proprietor. By this time, the Hook and Hastings factory was offering a variety of standard designs using tubular-pneumatic action. Its "size no. 14," for example, featured two manuals, twenty-six stops, pedal, and no independent aliquot stops; the Great and Swell organs were limited to one Mixture apiece.

Organs on Parade

The urge to produce larger, louder organs in the Romantic style (other terms might include *neogothic* or *Victorian*) was mirrored in the "exposition organ," an opportunity for builders to impress audiences and compete for business. Following in the mold of London's 1851 Universal Exposition at the Crystal Palace (with its well-received seventy-stop Henry WILLIS organ), American cities began to sponsor exhibitions and world's fairs that attracted huge crowds, eager to see the technology of the Industrial Revolution and then-current exotica. Philadelphia's 1876 Centennial Exposition featured a prize-winning Hook and Hastings (4/47; tracker with Barker lever; electrified 1925; rest. 1975–76; now in Buffalo, New York, St. Joseph's Old Cathedral) and a three-manual pneumatic Roosevelt with two electric (separated) divisions and blowers, anticipating the Roosevelts' use of electro-pneumatic action. The 1884 Cotton Centennial Exposition in New Orleans featured an instrument by William Pilcher and Sons, apparently a local branch of Louisville's Pilcher firm. The instrument (4/63) was moved to the Church of the Immaculate Conception in New Orleans after the exposition and reinstalled by Moller in the church's new building (1931); it became unplayable, was dismantled, and was eventually sold off.

The Columbian Exposition of 1893 in Chicago, the most impressive event of its kind to date, provided a spectacular bit of bad planning as well. The German-born Carl Barckhoff (1849–1919), who began his career in partnership with his father Felix in Philadelphia, had relocated to Salem, Ohio, by 1887, building more than three thousand organs before his firm closed in 1913. His four-manual instrument for the exposition's Music Hall could not be installed because its architects had changed the building's design after the original commission; the organ's subsequent history is unknown. Other builders were more fortunate; the Detroit firm of Farrand and Votey installed two instruments, while Henry Pilcher and Sons placed one. The University of Michigan, Ann Arbor, obtained the larger Farrand and Votey organ in 1913; it survives in the university's Hill Auditorium after several rebuilds (now 4/120); its style has evolved from the electro-pneumatic vanguard (using recently purchased Roosevelt patents) through "orchestral organ" (Skinner) to "American classicism" (Æolian-Skinner under Harrison).

One of the last significant event of this era was the 1901 Pan-American Exposition in Buffalo, New York. An organ built by Emmons Howard (1845–1931), who had worked for Johnson and Steere (see below), was installed in the very popular Temple of Music (4/65; tub./pneum., enclosed Choir). Robert Schumann's "Träumerei" (some contend it was a sonata by Johann Sebastian Bach) was being performed on the organ when President William McKinley was assassinated in the hall. The instrument was eventually installed in Buffalo's Elmwood Music Hall; when the hall was demolished in 1938, the organ was dismantled and eventually sold as scrap. Ironically, the real success at the exposition belonged to the Æolian Company, with its player organs and pianos, a new and growing market. The organ at the 1904 Louisiana Purchase Exposition in St. Louis is discussed below.

Technology and the Birth of the American Romantic Organ

The trends of the Romantic era in American organ building have been summarized by Ochse. Most of the new technologies were present in some form by the 1860s. The tracker action lost its mainstream role, gradually replaced by Barker lever, tubular-pneumatic, and finally electro-pneumatic actions. Where available, steady water pressure from underground mains or streams provided a new source for wind; later, electric blowers would serve this purpose. Toward the end of the century, electricity was applied experimentally to actions. Initially, batteries served as an expensive and somewhat unreliable source, and the convenience of electric wiring was not yet available; but the idea that electric action offered a promising alternative to "direct" action reflected the era's belief that "progress" was by definition an improvement.

Consoles experienced adjustment and innovation to a considerable degree. The crescendo pedal allowed the graduated bringing on and off of stops, giving organ composers new dynamic possibilities. Along with the previously mentioned balanced swell pedals, composition pedals used to bring on preset stop combinations were replaced with combination pistons (first used in Roosevelt's Philadelphia Centennial organ), located between the manuals, that not only made it possible to change combinations at the manuals but allowed the player to create his or her own combinations. Couplers and reversibles increased in number and complexity. Organ cases were less elaborate; indeed, other than Swell divisions, sections were frequently left uncased. Those who found this a bit too revealing used screens of metal or pipes to hide the "naked" divisions. Further, the desire for a chancel organ to accompany the choir during its processional to the front of the church (rather than use the gallery organ at the opposite end) was solved by the use of electricity to connect a chancel console with chancel and gallery organs for simultaneous play. Roosevelt built a three-manual chancel organ for New York, Grace Church (1878) in which he connected its console by wire with the already present 1830 Erben instrument in the gallery (3/26).

The tonal changes in the U.S. organ were the most distinctive quality of the Romantic era. There were many different impulses, not all complementary: increase of overall loudness, or at least the illusion thereof; greater dynamic contrast between loud and soft (early Baroque transformed into neogothic, perhaps); increasing use of 16'and 8' stops, producing a heavier tone interpreted as "impressive," "dignified," or "grand," in the manner of late Romantic music; the addition of 32' stops to the pedal; and a corresponding decrease in the use of aliquot stops and mixtures. The Quint and Tierce, so beloved of Cavaillé-Coll and his disciples, were perceived as too dissonant, much as English builders of the period felt.

The Roosevelts and the Goodrich Dynasty

The number of builders and new organs increased as assembly-line techniques and new technologies spread throughout the industry. In addition to earlier firms continuing their work, there were new builders doing important work. The Roosevelt brothers' innovative genius and business skills resulted in the production of an average of twenty-five organs a year over a twenty-two-year period. One of the firm's tonally unaltered instruments is at Great Barrington, Massachusetts, First Congregational (1883; 3/60; tub./electro-pneum., hydraulic blower, Audsley case; in use). Hilborne's premature death (1886) and Frank's early retirement

(1893; he died soon thereafter) cut short the history of the first American firm to spark genuine, even competitive interest from Europe; Frank sold off the Roosevelt patents to Farrand and Votey. But the potential for a Roosevelt legacy of instruments was not realized: Farrand and Votey began focusing on building player organs for Æolian, later adding the Pianola to its product line; the experimental nature of the Roosevelt organs made their maintenance more difficult than mainstream instruments; and the development of purely electric action (leading to the orchestral and theater organs of the early twentieth century) left the Roosevelts' electro-pneumatic accomplishments in relative obscurity.

The ODELL brothers, former employees of Ferris and Stuart, started their own firm in 1859. Although small, it successfully produced organs in a contemporary style, with a fine, 8'-dominated tone. The Odell organ at Brooklyn, New York, St. Charles Borromeo (1880; 3/35, hydraulic blower; now electric) is a tracker instrument; the company began experimenting with pneumatics in the 1860s and patented its own tubular-pneumatic action in 1898. The effects of the Great Depression and the neobaroque movement led to the company's closing in 1983; however, the firm was reopened in 2003, run by the fifth generation of Odell builders, now in East Hampton, Connecticut.

In addition to Hook and Hastings, Johnson and Son, and W. B. D. Simmons, other firms grew out of the "Goodrich dynasty." John W. STEERE (orig. Steer) and George Turner (1829–1908), who had worked for Johnson, opened their own firm in western Massachusetts (1867). The Steere and Turner firm's most famous organ is at Chicago, Greenstone (Pullman Methodist) Church (1882; 2/23; tracker, hydraulic blower; in use). After Turner left the firm around 1891 (he later worked with Emmons Howard), Steere continued building both tubular-pneumatic and tracker instruments from 1897 on. The firm was bought out by Skinner in 1921, one year after its factory burned down.

George S. HUTCHINGS of Salem, Massachusetts, became the leading New England builder of the latter nineteenth century as well as a lightning rod for innovations (and builders) to come. He worked for the Hook firm (1857–69), with an interruption to serve in the Civil War. In 1869 he formed a partnership with J. H. Willcox (who had worked with Hook after his partnership with Simmons dissolved) and two others as Willcox and Company. The firm went through various departures until 1884, at which point the company was Hutchings's alone until its merger with the Votey Organ Company as the Hutchings-Votey Company (1901). Through all these corporate changes, Hutchings gained a national reputation for his instruments, enlarging his Boston factory more than twofold to meet demand. He removed the 1863 Walcker organ from the Boston Music Hall and replaced it with a large one-manual tracker instrument for Boston's renowned Handel and Haydn Society's use (1884, 1/18). At Boston's Basilica of Our Lady of Perpetual Help, Hutchings replaced an organ he had built as part of Willcox and Company (1871, 1/8) with a French-influenced instrument (1897, 3/41; rest. H. Lahaise, 1968). The instrument was the first to use Hutchings's patented movable "bat-wing console," connected by wire to the rest of the organ, and full electric action, developed in collaboration with his colleague ERNEST M. SKINNER, whose major contributions were yet to come. The pipes were designed with the help of two English builders: Henry Willis (reeds), who exchanged this information for knowledge about the electric action; and Carlton C. MICHELL (string voicing), who came to the United States in the 1880s and had worked for Hutchings (1890–92) and others (Austin, Hope-Jones, and Jardine). Even after becoming Hutchings-Votey, the firm built important instruments (Seattle, St. James Cathedral, 1907; 4/52; console rest. Marceau, 1996).

James Treat (1837–1915) of New Haven, Connecticut, had worked with Johnson, Erben, and, after a hiatus, Hutchings (1876). Edward F. Searles helped him set up a factory in Methuen, Massachusetts, in 1888, where Treat built instruments under his own name with Searles's financial blessings. In 1894, Treat built a large instrument for San Francisco, Grace Episcopal (1894; 3/47), noted for its preset (nonadjustable) combinations and beautiful neogothic case; unfortunately, nothing could protect it from total destruction during the 1906 earthquake. The Methuen Organ Company, as Treat's firm became after 1898, was more fortunate with the 1909 reinstallation of the 1863 Walcker (extant) in what is now the Methuen Memorial Music Hall.

There was also fresh blood from England. Jesse and James Woodberry came in the 1880s, worked for Hook and Hastings and in partnership with James Cole until Jesse left the firm in 1888. Cole and James Woodberry built an instrument with Michell (Germantown, PA, St. Luke's, 1894; 3/38, hydraulic blower); one of the first tubular-pneumatic instruments in eastern Pennsylvania, this organ was divided into north and south sides of the church. JOHN T. AUSTIN and his brother Basil George Austin (1874–1958) came to the United States in 1889 and worked for Farrand and Votey. To offset unsteady wind and maintenance difficulties due to inaccessibility, John patented the Universal Air Chest (1893), which provided ready availability of air and an accessible bottom surface for tuning and regulating purposes. Ignored by their employer, the Austins joined Clough and Warren, another Detroit firm, in 1893, and incorporated the Universal Air Chest into its organs.

The Austins were installing an instrument in Hartford, Connecticut, Horace Bushnell Congregational (1898; 3/54; in use) when the Clough and Warren factory burned down. The Austins set up their own company in Hartford the following year; the company remains in business, now in the hands of the fourth Austin generation and in spite of a Depression-era reorganization, helped no doubt by John T. Austin's mechanical genius.

Western and Southern Expansion

While Pilcher and Kilgen thrived in their Louisville and St. Louis factories, respectively, other firms rose to prominence. Erie, Pennsylvania, benefited from the relocation of Silas L. Derrick and Abraham B. Felgemaker's firm (founded 1865) from Buffalo, New York, in 1871. One of Derrick and Felgemaker's last instruments was installed at South Bend, Indiana, University of Notre Dame, Our Lady of the Sacred Heart (1875; 2/31); it replaced the church's first instrument (Garret House, 1864; 2/31), and was itself replaced by a 1978 Holtkamp. Felgemaker (1836–1905) became sole proprietor in 1876, and continued to build large instruments; but his firm became best known for the Felgemaker Patent Portable Pipe Organ, a mass-produced one-manual instrument. Another builder, John L. HINNERS, started his John L. Hinners Organ Company, a reed organ firm in Pekin, Illinois (1881); he then formed a partnership with Ubbo J. Albertsen, a German émigré, in 1885. From 1890, Hinners and Albertsen built handcrafted pipe organs in large quantities for small churches and private owners, selling them by catalog on a direct-mail basis, without intermediaries (hence no commissions to pay). The firm survived the retirement of its founders in the first decade of the twentieth century, making the transition from tracker to tubular-pneumatic to electro-pneumatic action, and from manual to electric blowing. On one hand, most Hinners organs made some use of the by-now archaic slider-chest; on the other, it built several theater organs, sometimes of the unified electrified type. The combination of less expensive alternatives and the Great Depression finally forced the company to close in 1936.

Shortly after moving to Erie, Pennsylvania, Derrick and Felgemaker hired M. P. Moller (orig. Möller), a recent Danish immigrant. Lacking knowledge of music or organ construction as well as capital, Moller struggled for a number of years until the city of Hagerstown, Maryland, helped him establish a shop there (1881). The factory thrived, despite being burned down in 1895 (it was up and running again a year later). Moller followed the technological evolution of the instrument: building tracker organs at first, then tubular-pneumatic instruments (1902), and then electro-pneumatic instruments (1919). By 1896, the firm was making all of its metal pipes, a still uncommon sign of independence from European sources. Moller continued to produce instruments until its closing in 1992.

Cincinnati's Matthias Schwab (see above) took on two German emigrants as employees: Johann Heinrich Koehnken, in 1839, and Gallus Grimm (1827–1897), in 1853. When Schwab retired in 1860, his two employees took over the firm and renamed it Koehnken and Company. A surviving example of the firm's work is at the city's Isaac M. Wise Temple (1866; 3/38). The SCHANTZ Organ Company, founded by A. J. Tschantz (later Schantz) in 1873 as a reed organ manufacturer, began making tracker organs (1893–1913), gradually shifting to tubular pneumatics (from 1903). The firm, now run by the fourth Schantz generation, builds electro-pneumatic instruments, often with MIDI (musical instrument digital interface) capability. In Milwaukee, Wisconsin, the Prussian-born WILLIAM SCHUELKE operated a small shop in the 1870s, producing German-style tracker (and later, tubular-pneumatic) organs for Midwestern churches (such as New Vienna, Iowa, St. Boniface, 1891; 2/20; in use).

Farther west, the Mormon Tabernacle in Salt Lake City commissioned Joseph H. RIDGES, an Australian Mormon who had created the first ("old") Tabernacle's organ (1857; 1/7), to build a new instrument for the second ("new") Tabernacle. Ridges, who had come to the United States in order to install the first instrument, built the new tracker organ (1866–69; 2/26). The instrument was altered several times over the years: by Niels Johnson, who had built the organ with Ridges (1885; 3/46, four divisions), by the Kimball Company (1901; sixty stops, pneum.), and by the Austin Comapny, in 1915 (ca. one hundred stops, seven divisions) and 1940 (133 stops), before an almost complete rebuild by Æolian-Skinner under Harrison (1948; 147 stops, seven manuals; rest. Schoenstein, 1984–88). Parts of Ridges's case and a few of his pipes remain.

Organs had been in California since its Nueva España days, and several instruments were sent there by nineteenth-century builders. German-born Joseph Severin Mayer (1823–1909) moved to California in 1856 and set up a workshop in San Francisco. He built a small number of instruments, renting some to new churches until they could afford permanent installations. In 1868, he employed Felix SCHOENSTEIN, who founded Schoenstein and Company in 1877. Like most other San Francisco builders, Mayer and Schoenstein saw most of their work destroyed in the 1906 earthquake. Schoenstein persevered, and the firm has continued through three generations, building new organs, maintaining all Mormon Tabernacle instruments, and becoming the first California firm to install large instruments on the East Coast. Los Angeles's first organ-building firm was founded in 1895 by Henry C.

Fletcher, an organist, and Murray M. Harris; the latter had moved West after working for Hutchings. Fletcher soon left the partnership, and Harris began a brief, up-and-down career, leaving the trade in 1913. His earlier instruments (among them Los Angeles, First Methodist Episcopal, ca. 1900; 3/40) seemed modest enough; a few years later, however, Harris would participate in the building of a far larger instrument, the so-called Wanamaker organ (see below).

Extreme Romanticism, Gradual Reaction

The United States entered the 1900s with increasing confidence, a national pride reinforced by its victorious role in World War I. Many builders were hurt by competitive realities—the number of U.S. organ firms declined from ninety-four (in 1904) to around sixty (in the 1920s)—but productivity in the 1920s doubled that of the previous fifteen years. The war had reduced available materials and, to a lesser degree, personnel, but the industry did not suffer greatly.

There were familiar reasons for continued success. The late-nineteenth-century impulse toward larger instruments continued into the first three decades of the new century. There were still church organs to be replaced. Expositions continued to dot the landscape, offering commercial opportunities for builders. The impulse to innovate was at fever pitch; many older instruments were rebuilt, adding electrically driven actions, duplexing, pipe tuning sliders, increased nicking and cutting, "improved" reed pipes, more manuals, and increased wind pressure. Some believed that these refurbished instruments would be superior to totally new organs by virtue of stops that were retained or at least the basis for new stops. Historicism had not yet reach the American organ world.

There were also new opportunities for the builder, due in part to electricity. By the latter part of the second decade of the 1900s, the silent cinema was the rage of the country. Theater owners who presented live entertainment continued to hire instrumental ensembles, but others found that a single musician on an organ, with all its potential colors and sound effects, could provide effective and well-synchronized "commentary" on the films and provide interludes while reels were being changed, when the film broke and needed repair, or as part of the overall program—greater flexibility at a lower cost. The THEATER ORGAN evolved into an electro-pneumatic or electrically driven multi-manual instrument with numerous stops and "traps," as sound effects were called, and the characteristic concave half-circle of stop tablets embracing the organist. The Wurlitzer Company was most closely associated with the theater organ, but several other American firms manufactured them: Austin, Barton, Kilgen, Kimball, Marr and Colton, Midmer-Losh, Moller, Robert Morton, Page, Reuter, and Viner.

Electricity also made radio possible and, as the medium increased in technical sophistication and the demand for broadcast music grew, radio studios began to be connected to organ studios by wire, making live organ recitals feasible (from 1922 on). Later, radio studios purchased their own in-house instruments to function much as they had in cinemas. Parallel to this development was recording organs for 78-rpm records.

When "silents" became "talkies," the theater organist saw a steady decline in job opportunities. In those theaters where vaudeville and other live theatrical entertainment remained tenable, organists such as Gaylord Carter, Lee Erwin, Frank Loney, Everett Nourse, and the most famous of all, Jesse Crawford, continued to perform before live audiences and on radio; Erwin and others lived long enough to participate in the lively theater organ revival, spearheaded by the American Theatre Organ Society.

American Gigantism: British Salvos on U.S. Shores

The era also produced the two largest organs ever built—both in the United States, the indirect products of a major controversy in the organ-building community. The first, built by the Harris firm (and its successor, the Los Angeles Art Organ Company) despite huge financial difficulties, was destined for the 1904 Louisiana Purchase Exposition in St. Louis. It required a ten-car train to bring the parts to Festival Hall, where the organ was installed. George A. Audsley, the Scottish architect who came to the United States (via London) in 1892, designed the instrument (5/140) to be the ultimate in orchestral organs, expanding European (i.e., Cavaillé-Coll and Walcker) registrations to their greatest degree to date. Audsley distinguished between church and concert organs; where the former had a Choir division, the latter had an Orchestral division that, in larger organs, would divide into separate woodwind and brass manuals. The Ancillary Organ or floating division was most often dedicated to the strings, which could be coupled with woodwind, brass, or both. Audsley's design for the Exposition organ was evidently successful, as it pleased French virtuoso Alexandre Guilmant (1837–1911), the featured performer at the exposition. The organ was destined for Kansas City, but instead went into storage until 1909, when John Wanamaker purchased the instrument for his new department store in Philadelphia. It underwent a number of enlargements between 1914 and 1927 (6/461). It has remained a recital instrument in the store, which is now Lord and Taylor.

The other instrument was based on theater organ principles. Designed by Emerson Richards, it was built by Midmer-Losh for the Atlantic City, New Jersey, Convention Hall (1929–32, 7/449, now Boardwalk Hall). The instrument did not meet its highest aesthetic expectations; it soon became a pop concert vehicle, even accompanying ice skating shows. It suffered damage at the hand of a 1944 hurricane and, despite subsequent repairs, became unusable in the late 1990s after damage from building renovations. The Atlantic City organ made use of many concepts that originated with Robert Hope-Jones, an Englishman whose inventiveness was matched by a self-assuredness that attracted disciples and opponents alike (the latter group included the feisty Audsley). Hope-Jones had come to the United States in 1903, beginning a series of troubled alliances with Austin and Skinner before forming his own short-lived, financially troubled company; thereafter he collaborated with Wurlitzer, sold his patents to that firm, and took his own life. During his career, he promoted fully enclosed organs (using concrete for the swell boxes), increased wind pressures (and the potential for greater dynamic contrast), diaphones ("valvular reeds"), unification (duplexing and transmission), the double-touch key, and the unit organ (with divisions according to orchestral section rather than the balanced Werkprinzip). He disdained mixtures and aliquot stops, and furthered their decline. He insisted that his instrument for the Ocean Grove, New Jersey, Great Auditorium (1908, fourteen stops) was "easily the most powerful instrument in the world"; this organ has been completely transformed into a five-manual, 152-rank instrument and is in use today. He understood that his kind of instrument was intended for "light and popular music," not church and classical music performance; but he believed that particular concepts could be applied to any kind of instrument. It was, in the end, the theater organ manufacturers led by Wurlitzer that made the most of Hope-Jones's ideas.

Skinner was as brilliant in his craft as he was stubborn in his views and difficult in his dealings; Ambrosino calls him "a crusty, feisty, flinty, dapper little man who had obviously read his Mark Twain." He left Hutchings in 1901 to form his own firm in Boston, was joined by Goodyear Tire executive Arthur Hudson Marks (1874–1939) in 1916, and began working with G. Donald Harrison in 1927. Unhappy with Harrison's more modern, less "orchestral" approach, Skinner sold his shares of his firm in 1929 to buy the Serlo Organ Hall in Methuen, Massachusetts; this only increased the pressure placed on him by Marks and Harrison. While retaining contractual ties to the firm (now the Æolian-Skinner Organ Company) through 1936, Skinner gradually shifted his building activities to his new company, and built organs in Methuen until his factory burned down. Throughout his career, Skinner followed the principles of the late Romantic orchestral organ, with a reliance on octave stops, especially 8' (Dallas, First Presbyterian, 1928; 3/36, twenty-four 8' stops, one mixture, no aliquots; rest. Sipe, 1977). His larger instruments did include 2' stops and aliquots, and a greater number of mixtures—particularly those that show some Harrison influence (Toledo, Ohio, Holy Rosary Cathedral, 1930–31; 4/60; three mixtures, two aliquots). Skinner was not a strict orchestral-style builder in the Hope-Jones mold, allowing more variety within divisions and making more limited use of unification. He deftly incorporated the technology of the day: the pitman chest (his invention), electro-pneumatic swells, adjustable combination actions, and electric key action; the last allowed "the disassociation of the touch of the wind pressure." This gave organists the agility to perform rapidly repeated notes as well as the symphonic transcriptions and other virtuosic music favored in his day, but was the total antithesis of the "touch" inherent in tracker action. (Skinner did not worship at the altar of Bach.) He was unquestionably one of the best stop builders of his era; while some of his organs were subsequently "modernized" in the American classic style, a large number of Skinner stops have been reused in cases where the organs themselves were dismantled.

Action, wind pressure, and tonal character were not the only areas of experimentation and controversy. The console was especially subject to discussion; builders could opt for stop tabs, tilting tablets, or drawknobs, with or without lights; expanded keyboard compass; dead (dual) versus visible (absolute) combination pistons; and the design of the pedalboard. The American Guild of Organists spent many years attempting to set console standards; it finally succeeded in 1933, establishing the sixty-one-note manual and thirty-two-note pedalboard.

An aesthetic conflict arose when the tendency to "hide" the organ became an obsession for some builders (and buyers). Architectural devices such as fences of dumb pipes, metal grills, curtains, and columns were available; even more "impressive" was the use of basements and, even more radically, the enclosure of the Great and Pedal. The intensity of the high-pressure 8' tone of the orchestral organ would appear to compensate for the buried pipes, but the honest organbuilder could never allow that disrupting the flow of sound between its source (pipes) and recipients (congregation, etc.) might be a plus.

The American Orgelbewegung: The American Classic Organ

The reaction to the American orchestral and theatrical organ movements came in two stages and was further complicated by the development of the Hammond electronic organ (which led to a 1937–38 court case in which pipe organ–builders challenged Hammond's right to compare its product with their own). The first stage, spearheaded by Harrison at Æolian-Skinner, involved both a revival and a reinterpretation of the French organ of Cavaillé-Coll into an instrument that could play all organ repertoire, including Bach, satisfactorily. This meant reducing the emphasis on 8' stops, reintroducing mixtures and aliquots, eliminating the orchestral division, and lowering wind pressures. Harrison established the basis for the so-called American classic style in the 1930s, a starting point for those wishing to do away with all traces of Hope-Jones and, to a lesser degree, Audsley. Skinner, who continued building until 1943, lived long enough to see his former colleague and others dismantle his own orchestral ideal.

Harrison's organs dominated the market until the end of World War II; two instruments from 1937 demonstrate the scope of his work. For the University of Rochester, New York, Strong Auditorium (moved to Kilbourn Hall, Eastman School of Music; in use), he built a four-manual, seventy-four-stop instrument with almost no duplexing, including mixtures and a 2' stop on the Pedal, and a richly developed Flute chorus on the Great. He also included a Rückpositiv, still a relatively unknown division to American builders. The other instrument, at the Germanic (now Busch-Reisinger) Museum at Harvard University, was the result of E. Power BIGGS's encouraging the museum to have a musical representation of German culture and convincing Harrison to build an "experimental" organ (2/25) with a straightforward German stoplist and fewer couplers. (Harrison had begun working with these elements a few years earlier.) The organ became nationally known when Biggs offered a weekly radio recital series on it (from 1942 until 1958, when the organ was removed). Although it had a electric action (and therefore lacked the articulation of a tracker organ) and was not in a particularly effective acoustic space, its cleaner sound was a revelation to those unfamiliar with Baroque organs and a spur to further investigation. (It was destroyed by fire elsewhere in 1971.)

Walter HOLTKAMP worked in a small partnership in Cleveland; he used organ periodicals to voice increasingly barbed warnings against trends in orchestral organ building. He believed that (1) consoles had to be simplified by reducing the number of couplers; (2) money should be spent on independent stops; (3) unification had to be eliminated, and (4) organs should be designed for specific spaces, with open, unobscured placement the ideal. Holtkamp's first splash was a nine-rank Rückpositiv division added to an electropneumatic Skinner in the Cleveland Museum of Art's Garden Court; the uncased division was set up on a gallery rail. An all-Bach recital series (twenty concerts, 1933–34) attracted favorable attention, and Holtkamp began building a series of increasingly ambitious instruments known for their visible, uncased pipes, placed in freestanding swirling designs, intended to produce unobscured access to the blending of individual, nonduplexed stops (New Haven, Connecticut, Yale University, Battell Chapel, 1951; 3/54, based on German models; in use). Holtkamp retained somewhat old-fashioned voicing and stayed with electropneumatic action, but his accomplishments, based on close study, intuition, and a very confident ear, were as important as Harrison's in rerouting American organ building toward the future. Their work brought American organ building past World War II and into the next era, along with that of Æolian-Skinner, Austin, Moller, Robert Noehren (Buffalo, New York, First Presbyterian Church, 1969; 4/70, based on French models; in use), and Herman L. SCHLICKER, whose collaboration with architect Eero Saarinen (Fort Wayne, Indiana, Concordia Theological Seminary, Kramer Chapel, 1958; orig. 3/38; in use) provided a stunning model for builder-architect teams to come.

The Neoclassical and Beyond

World War I and the subsequent European economic depression had allowed American builders to solidify their hold on the U.S. market. But their European counterparts were beginning a stylistic revolution that would change American thinking radically decades later. At the turn of the twentieth century, editions of old organ music, reconsiderations of performance practice (led by Arnold Dolmetsch), and the writings of Albert SCHWEITZER ignited a reconsideration of the authenticity issue. At first, there were attempts to build organs that combined German and French elements, not unlike the later American classic instruments. But when Europe returned to relative normalcy in the 1920s, the ORGAN REFORM MOVEMENT began in central Europe, ignited by the Oscar Walcker–Wilibald Gurlitt 1921 construction of an instrument based on Michael PRAETORIUS's *De Organographia* (*Syntagma musicum* II, 1619). The reformers took several tacks: studying the organs and stoplists of older builders, especially Arp SCHNITGER and Gottfried SILBERMANN; recognizing (and naming) the Werkprinzip that had served Renaissance and Baroque instruments; voicing and tuning pipes with a minimum of nicking; lowering wind pressures; and building new instruments with tracker actions and slider-chests (by the late 1930s) and restoring older instruments according to original principles (if not always authentically). The result was the neobaroque or neoclassical organ.

Beginning in the 1920s, Americans resumed traveling to the Old World for cultural education and technical information. Biggs, Noehren, Richards, Skinner, organist Carl Weinrich (1905–1991), and others made the pilgrimage to see older European instruments, note more recent developments, and adjust their approach to building and performance accordingly. But when American organists sought to participate in the postwar "authenticity movement," they found that the instruments they needed were not to be found in the United States. So churches and schools began to import instruments from European builders (all before 1962): Jürgen AHREND, Rudolf von BECKERATH, Werner Bosch (Germany), D. A. FLENTROP, Josef Mertin (Austria), METZLER, RIEGER, STEINMEYER, Späth (Germany, now Freiburger Orgelbau), van VULPEN, and Walcker. The one concession to modern sensibilities was the use of electric blowers (usually made by LAUKHUFF), although smaller instruments had the option of hand- or foot-operating winding.

The American debate between old and new took a sharp turn in the 1940s, focusing first on tracker versus electric action, then slider versus pitman chest; the fireworks flew in the journals, but World War II stopped all commercial organ building for its duration. The debate continued through the 1950s; in the process, some American builders began to divorce themselves from the American classic philosophy.

The philosophy behind the authentic performance movement became the watchword of these builders, manifested in two criteria. First was the idea that instruments should be made (or restored) to match as closely as possible the technical and tonal structures that a particular organ composer would have expected when writing music. For the organ, this would be a hugely complicated matter: part imitation, part reconstruction, and a mass of detail. Second, and the more difficult concept for American builders, was that organs should be built for one repertoire, be it national or stylistic, and one only, rather than try to combine two or more into a single instrument, however convenient or economical that might be. Again, this has its parallels in the rest of the musical world—singing style; the choice of violin bow; or playing Baroque, rather than modern, flutes—but choosing an organ appropriate for the works of Dietrich Buxtehude, Felix Mendelssohn, Daniel Pinkham, Arnolt Schlick, or Charles-Marie Widor (not to mention different periods of Bach's output) demanded a break from the all-in-one thinking of American consumerism. Instruments would for the most part need to become smaller, a challenge to the American belief that "bigger is better." Another trend became apparent; the American market, which had shifted toward exposition, theater, municipal, and concert hall organs in the first half of the twentieth century, began to shift back toward religious institutions, whether by restoring old or building new instruments.

Slowly, American builders began to accept the mandate of the ORGAN REFORM MOVEMENT. Otto HOFMANN rebuilt a few older tracker instruments in the 1940s, then built two of his own, one unenclosed (San Antonio, Texas, Beacon Hill Presbyterian, 1955; 2/10), one (Albany, Texas, Matthews Memorial Presbyterian, 1956; in use) with a case by Joseph Blanton, who wrote two definitive works on organ cases and architecture. Although Hofmann would build or restore in the style appropriate to the instrument, his 1956 organ signaled the revival of commercial tracker organ building in the United States. He imported pipes from Flentrop, as no American pipemaker could produce "new Baroque" pipes at the time; this trend continued until the 1970s.

During this time, Charles B. FISK, who apprenticed with Holtkamp and was employed at ANDOVER, contemplated the issues raised by the organ reform movement. Although he became president at Andover, Fisk left in 1961 to form his own firm, concentrating on tracker organs exclusively. His last organ under the Andover name (Baltimore, Mount Calvary Church, 1961; 2/36; in use) is considered by many to have been the major breakthrough for the American neoclassical movement. Fisk gave it the appropriate disposition (three divisions, with a balance and variety of flues and reeds), low wind pressure (if large reservoirs), Baroque-style voicing and scaling of pipes, balanced key and stop action, and slider-chests. In 1969, Fisk published an article, "The Organ's Breath of Life," that supported a slight unsteadiness of wind in the Baroque manner, challenging more than a century's effort to achieve absolute consistency of winding. He carefully gave the organ an acoustically sound location (on the gallery, with the Rückpositiv on the rail) and a traditional if modest case, permitting optimal sound projection (and signaling the end of the Holtkamp "invisible case" vogue). Modeled after Flentrop's stoplists, the instrument is a mix of Andreas SILBERMANN (manuals, including Tierces) and Schnitger (pedal). Fisk spent the rest of his career building tracker instruments, including the first American neoclassical four-manual organ (Cambridge, Massachusetts, Harvard University Memorial Church; 4/49; in use).

While Fisk was the first American neoclassical builder recognized internationally, he had an increasing number of fellow travelers. Builders listed in a 1964 survey included Andover, Fisk, Hofmann, Charles MCMANIS, and the German-born Fritz Noack, who apprenticed with Beckerath and worked for Fisk before starting his own firm. Other builders of this "first generation" of American reformers included ABBOTT AND SIEKER, Rubin S. FRELS, Moller, and Lawrence I. PHELPS, who made a mechanical key/electric stop action organ for Hexham Abbey in England (1974; 2/34), the first American-made instrument of its kind for a European destination.

While neoclassical organs and builders began to dot the American landscape, the American classic organ did not disappear, at least philosophically. All pipe organbuilders took the technical lessons of reform to heart, and were more appreciative of acoustic environment when designing instruments. But many builders were asked to build church organs that could play both French and German, or Baroque and Romantic, styles, to make the instruments viable as liturgical and performance instruments. Pipes were made using Baroque methods, including the avoidance of nicking, but the dispositions were a balance of styles, without duplexing or excessive coupling. Another compromise involved limiting the use of electricity, usually to power the pedal division. (The Wicks firm spent decades perfecting its own "electromechanical" technology, in which a depressed key signaled an electromagnet to move an individual pallet.) In sum, a new eclecticism (and pragmatism) was pervading the American organbuilding scene.

Beginning in the 1960s, a "second generation" of reformers made their debuts as builders and restorers. The leading figure of this group was John Brombaugh, who apprenticed with Noack and Fisk (and worked for Beckerath) before starting a firm in 1968 in Ohio with George Taylor, his former apprentice. (Taylor, who left in 1976, started Taylor and Boody with a former Noack apprentice, John Boody.) Brombaugh moved to Eugene, Oregon, and continued to build tracker instruments that set the standard for American builders (among them Collegedale, Tennessee, Southern Adventist University, 1985; 4/108, largest tracker organ in United States; in use). His contemporaries include Gene R. Bedient, Richard L. Bond, George Bozeman Jr. (who had apprenticed with Hofmann), Kenneth Coulter, Lynn Dobson (who had apprenticed with Hendrickson), Steuart Goodwin (who had worked for Flentrop, Manuel J. Rosales, and Schoenstein), Charles Hendrickson, Lewis and Hitchcock (an older firm that started late), David Moore (who had apprenticed with Fisk), Martin Ott (who had worked for Walter Holtkamp Jr.), Roy A. Redman, Manuel J. Rosales (who had apprenticed with Schlicker), Robert L. Sipe (who had worked for Æolian-Skinner after Fisk), Steiner-Reck, and Visser-Roland (now Visser and Associates).

The "third generation" of reformers includes a number of former Brombaugh apprentices: Michael Bigelow; Paul Fritts; Daniel J. Jaeckel; Richards, Fowkes and Company; and Charles M. Ruggles; another, Greg Harrold, worked at one time for Abbott and Sieker. Others include John-Paul Buzard, Stephen R. Cook, Stefan Maier, Martin Pasi, Petty-Madden, Bradley Rule, Russell and Company, and Wissinger. While many of these builders continue in the "purist" neoclassical mode of Fisk and Brombaugh, a number have been less strict in their applications of organ reform tenets, whether out of conviction, financial necessity, or both. But this is a sign, also, of a long-awaited relaxation of the struggles between tracker and electric actions, and the freedom to experiment. Otherwise, the Levsen Organ Company of Buffalo, Iowa, might never have introduced an all-electric, tracker action unit organ in sizes ranging from four to eleven ranks for purchase by smaller churches.

Where will the American-built organ go? The overall market has shrunk to less than 10 percent of its heyday in the 1920s, and will certainly never come close to recovering in full. One recent trend is the application of the conservation principle to the Romantic organ—restoring turn-of-the-twentieth-century instruments and undoing some of the changes rendered to them by post–World War II builders. Indeed, restoration of all kinds of organs remains a viable market; but the United States is simply not old enough to provide the amount of work available in Europe. The money available to American religious institutions to rebuild old organs or build new organs has diminished with the decentralization of most denominations, spiritual revival or not. And the successor to the church instrument, the electronic organ, is as acceptable to most ears as are pipe organs, particularly as the popular music and jazz associated with the newer instrument dominates the musical world. This pattern continues with synthesizers and, even more a threat to the builder, the digital instrument with sampling and MIDI capability that is beginning to replace the pipe organ in some churches. But historical, intellectual, and musical curiosity on the part of builder and patron alike, and the hope that amateur ears can come to appreciate the differences between the "genuine" and the "imitation" (especially where "the organ's breath of life" is concerned), should ease the fears of pipe organ partisans. That the U.S. organbuilder has come to be considered an equal to European makers may be demonstrated by the controversial choice, by officials at the thirteenth-century cathedral in Lausanne, Switzerland, to commission the Charles B. Fisk firm to install a new instrument (2003; 5/124)—to great acclaim.

Richard Kassel

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UNITED STATES, FUTURE OF THE PIPE ORGAN IN

Rejected by the early Puritans, the pipe organ became a fixture in American churches before the middle of the nineteenth century. As communication and transportation became more sophisticated, organs were installed in thousands of churches across the country. Technological advances that appeared with the Industrial Revolution were applied to organ building, leading to such innovations as pneumatic and electric playing actions. The unprecedented explosion of wealth in the early twentieth century resulted in the construction of thousands more instruments, ever larger and more complex, often replacing venerable nineteenth-century instruments. The effects of industry on artistic content, coupled with the decline of wealth leading up to World War II, caused a significant drop in the quality and artistry of pipe organs. An energetic renewal of interest in earlier styles and practices of organ building dominated the second half of the twentieth century. This renewal, aided by another great burst in personal wealth toward the end of the twentieth century, allowed the return of high levels of artistic and mechanical achievement to the trade. In the first years of the twenty-first century, U.S. organbuilders are producing organs of the highest quality in every style.

Concurrently, the renewal of interest in historic organ building encouraged organists to research historic styles of playing and how the music of various regions and epochs related to the instruments of the day. Such scholarship was a major hallmark of organ playing in general during the second half of the twentieth century, and it led to a new maturity of musicianship to accompany the ever-increasing quality of new organs. During the last quarter of the twentieth century, many American cities invested in monumental, secular pipe organs installed in concert halls and civic auditoriums, broadening the reach of the instrument outside the walls of the church. These large public installations have been celebrated with the commissioning of significant new music for the organ, both as a solo instrument and with the symphony orchestra.

These factors combine to predict a strong future for the organ, in which high-quality instruments and exceptional players will be widely heard by the listening public, offering compelling music from this and earlier ages, giving the "king of instruments" a modern voice. A broad overview of the last half of the twentieth century shows it as a period of introspection and growth; the twenty-first century will surely see the exuberant continuation of high artistic achievement.

JOHN BISHOP

UNIT ORGAN

Robert Hope-Jones's concept of enclosing the Principal, Flute, String, Reed, Percussion and other families in separate chests, rather than a WERKPRINZIP approach of balanced divisions. His "master swell shoe coupler" made this arrangement feasible. The expense of such a system made it impractical for theater organ building, but it was replaced by Hope-Jones's UNIFICATION system.

See also **Extension Organ; Unit Chest**

UNIT STOP

A stop that realizes the UNIT CHEST or extension organ principle in its tonal form; a single stop that triggers a preset or performer-controlled collection of ranks. The

UNIT ORGAN, which arose after the application of electro-pneumatics, led to the principle of an individual CHEST for each pipe and its subsequent versatility, an idea that survived full electrification. The flexibility of unit stops has led to criticism, mostly aimed at organists who use a unit stop as a kind of tonal crescendo and produce what some experience as less well-tuned and odd mixtures of sound.
See also **Stop**

UNIVERSAL CHEST

SEE ACTION

UNTERWERK

(Dutch *Onderpositief.*) A division of pipes placed below and (often) in the back of the HAUPTWERK in northern Europe from the latter sixteenth to early nineteenth centuries. Its primary function was to fill the role of the now displaced RÜCKPOSITIV, and is sometimes called the ECHO organ. It could also be considered a form of Brustwerk. Not to be confused with the *Untersatz*, generally a 16' or 32' Grand Bourdon stop.

UPPERBOARD

SEE TOE BOARD

V

VAN COVELENS, JAN
See Covelens, Jan van

VAN DAM
See Dam, van

VAN DEN HEUVEL
See Heuvel, van den

VAN DER DISTELEN, DANIEL
See Distelen, Daniel van der

VAN HAGERBEER
See Hagerbeer, van

VAN OECKELEN
See Oeckelen, van

VAN PETEGHEM
See Peteghem, van

VAN VULPEN
See Vulpen, van

VATER, CHRISTIAN (CA. 1679–1756)
German organ and harpsichord builder and organist. He studied organ building with his father, Martin Vater (Celle, Stadtkirche, enl. 1681 Kroger-Huss, 1686; reconstr. R. West, 1999; 3/49) and worked for Arp Schnitger (1697–1702); he then started his own workshop in Hannover. Other than his instrument building, Vater's life is relatively obscure; he did become organbuilder to the Hanoverian court, and was succeeded at that position by his son Johannes Vater after his death on 25 Jan 1756.

Christian Vater was primarily active in northern Germany, although he did some important work in Amsterdam in the 1720s. His style reflected that of Schnitger, who had done his own work in the same region. Vater built at least thirty-five new organs, rebuilt a few others, and helped maintained over 175 instruments. His instruments include Delmenhorst, Stadtkirche (rest. 1711 Schnitger; 1718; repl. J. C. Schmid, 1880); Elsfleth, St. Nikolai (1719–21; 2/20; reb. Schmidt, 1836; rest. Führer, 1954–55); Bockhorn, SS Cosmas and Damian (1722; reb. Führer, 1966; rest. Führer, 1970s); Melle, St. Petri (1724; 3/37; reb. Rohlfing, 1864; reconstr. Edskes, 2000); Amsterdam, Oude Kerk (repl. 1539 Niehoff-Suisse; 1724–26; 3/44; reb. J. C. Müller, 1738–42; 3/53; reb. Witte; 1869; rest. Blank, 1988; now 3/55); Amsterdam, Catholic Church "De Ooyevaar" (ca. 1725; to Bunschoten, Reformed Church "De Bron," 1914); Amsterdam, Westerkerk (enl. 1868 Barentsz.-Duyschot; 1727; added Bovenwerk; 3/42; reconstr. Flentrop, 1992; now 3/45); Wiefelsteded, St. Johannes (1731; extant); Burhave (reb. 1705 Schnitger; 1733; incorp. J.

C. Schmid, 1879); Gifhorn, St. Nikolai (1748); and Wilhelmshaven-Fedderwarden, St. Stephanus (2/18).

Only one harpsichord by Vater survives (1738; now at Germanishes Nationalmuseum, Nürnberg).

RICHARD KASSEL

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VEGEZZI-BOSSI

Italian organ-building dynasty. The genealogy behind this conglomerate will not be discussed in full here (see bibliography). The Bossi workshop began during the sixteenth century in Mendrisio/Ticino; it was moved to Bergamo in 1635, then to Lodi by Carlo Bossi (1770–1836; Malegno/Brescia, S. Andrea, 1824; 1/15, divided stops; rest. Borghi, 1973), son of Giuseppe Bossi (1738–1803; Bergamo, Almenno San Salvatore, 1760; 1/21). Along with the Serassi family of Bergamo, Bossi began working toward an Italian postclassical organ, layering new imitative stops over the traditional Principale chorus and flutes. Two-manual organs became more common in larger rooms, but one-manual instruments continued to flow out of Italian workshops.

In 1850, Carlo's son Felice Bossi (1795–1873; Bergamo, Cathedral, 1842, 1/20, divided stops) moved the firm to Turin. His adopted son from his wife's first marriage, Giacomo Vegezzi (1825–1883; Turin, Cathedral, 1874; 2/66, mech.; rest. Piccinelli, 1972), built several organs in the Turin and Piedmont regions. Taking the surname Bossi-Vegezzi, Giacomo married and had a son, Carlo Vegezzi-Bossi I (1858–1927). Giacomo's second marriage was to Annetta Vittino (1816–1886), organbuilder and daughter of Carlo Vittino (1795–1868), a respected organbuilder in Centallo/Cuneo; this marriage produced another son, Francesco Vegezzi-Bossi I (1870–1943). The Bossi-Vegezzi and Vittino firms collaborated on exposition organs and other projects, but never formally merged; Francesco Vittino (1849–1923) was the last Vittino builder (over 125 instruments).

The half-brothers Vegezzi-Bossi were to form one more merger. Carlo I's daughter Alessandra married Celestino Balbiani (1880–1956), a third-generation builder of Lombard origin, in 1919. The Balbiani and Vegezzi-Bossi firms, which had been on good terms since the mid-nineteenth century, formed a new company, Balbiani–Vegezzi-Bossi, in 1927 (Loreto, Basilica, 1950; to San Benedetto del Tronto Cathedral, 1995). This name was used until the 1980s, but the Balbiani family did not play an active role in the new company, and continued to build on its own for a time. Francesco I was the active builder on the Vegezzi-Bossi side, having formed "Vegezzi-Bossi di Centano" (1908) before the Balbianis entered the scene; he built organs using electro-pneumatic technology. Francesco I's son Carlo Vegezzi-Bossi II (1900–1977) ran the firm during a difficult era, but did introduce electric action. His son Francesco Vegezzi Bossi II (1937–1984) continued exploration of electronics and began studying the art of restoration before his early death. His son, Enrico Vegezzi-Bossi (b. 1964) has continued the learning process, along with his partner, Bartolomeo Brondino (b. 1861), who joined in 1984. The firm is now called Vegezzi-Bossi di Brondino Vegezzi-Bossi.

Hundreds of organs built by different incarnations of Vegezzi-Bossi dot the Italian landscape. While few of their instruments have the immense tonal grandeur of German or French four-manual organs, they are not intended to share that quality (although Vegezzi-Bossi could produce an instrument like the 1954 Sao Paulo Cathedral organ, with five manuals and 120 stops, when asked to do so). Even in the recent past, when Romantic and post-Romantic ideas entered the consciousness in Italian organ building, the renewed popularity of older techniques has led Vegezzi-Bossi and others to relearn the old ways. Many Italian organs have survived or are capable of being restored because of their past "old-fashioned" technology: the continued use of spring-chests and mechanical action until late in the nineteenth century, and the limited use of electric actions in the twentieth century. The Brondino–Vegezzi-Bossi partnership has been active in this process: Naples, Arciconfraternita dei Pellegrini (1828 Curci positive; 1995; 1/9); Pietraporzio, S. Stefano (1839 Carlo Vittono; 1993; 1/13); Millesimo (Savona), Notre Senora del Deserto (1855 Agati; 1995–97; 1/18, divided stops); S. Damiano d'Asti, S. Vincenzo (1888 Carlo I; 1992; two manuals, mech.); Aosta, Cathedral (1902 Carlo I; 3/44; pneum.); Cattedrale di Salluzo, Maria Vergine Assunt; 1908 Francesco I; 1998; 2/35; mech.); Rome, S. Maria sopra Minerva (1909 Carlo I; 1998; 3/34, pneum.); Alessandria, Cathedral (1929 Balbiani; 1994–96; three manuals, electro-pneum.);

and Mondovì (1939 Francesco I; 3/48; electro-pneum.). New instruments include Nardò (Lecce), S. Gerardo (1993; 3/12); Rosta (Turin), S. Michele Arcangelo (1994; 2/13); Sestri Levante (Genoa), S. Antonio (1995; 3/42, mech.); and Turin, Accademia del Santo Spirito (1995; 1/3).

Richard Kassel

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VENEZUELA

Conquered and colonized by the Spaniards in the sixteenth century, Venezuela was a poor frontier province of the Nueva Granada vice-royalty. Its organ history is bonded to Spanish Catholic Church tradition and economics, and shows strong French influence. Except for the mention of an organ and an organist in Caracas in 1591, there is no surviving documentation on sixteenth- and seventeenth-century organs or organ music in Venezuela. In 1711, Claudio Febres, a French immigrant, built an organ for Caracas Cathedral. In 1720, Nicolás Bartolomé de Clermon, another French immigrant, built organs for El Tocuyo and other locations, as well as repairing several organs (until 1787). A 1771 inventory by Bishop Mariano Martí counted forty-one organs in the Caracas diocese and ten more in other dioceses. The first significant performer was Cayetano Carreño (1774–1836).

The 1812 earthquake and the war of independence (1811–1821) destroyed many instruments. But two organbuilders, Gregorio Ascunes and Charles Nouvel, built new instruments for the most important churches in the country (1800–1827); Ambrosio Carreño, great-grandfather of the pianist Teresa Carreño, founded a dynasty of organists. Between 1831 and 1870, Nouvel pupil Esteban Jourdens built more organs. In 1866 he made the second documented organ inventory: there were thirty imported and ten native organs in the country. The local organbuilders were artisans, not manufacturers; they built positives of one manual, between three to four octaves, two to six stops ranging from 8' to 2', wooden pipework, no reeds, and plain casework without a facade. The end of the century saw the the economic boom caused by the sales of sugar, coffee, and cocoa. Most older organs were replaced by new European instruments, among them those of Aristide Cavaillé-Coll (nine organs), Robert Stoltz (one) and Harrison and Harrison (one). There were several organists who doubled as technicians: Juan Bautista Abreu, Felix Chevreux, Manuel Montoya, and Ramón Delgado Palacios, a student of Eugene Gigout and Alexandre Guilmant.

The pattern of importing instruments continued into the twentieth century, including two by Charles Mutin and two by Debierre. The World War II era brought an oil boom, and European immigration brought great changes to social and cultural life. German and Spanish organs were now imported as well, but the situation in Europe led to their being of less than ideal quality. Kurt Schmeltzer, a German immigrant, built new pipe organs with Laukhuff supplies and repaired existing instruments. Beginning in 1960, the arrival of the Electronic Organ and the Vatican II liturgical reforms led to the abandonment or loss of many pipe organs. Three Detlef Kleuker organs were imported by German Lutheran congregations in Caracas and Valencia between 1964 and 1971.

Organology and conservation became important elements of Venezuelan organ culture. Chilean organologuist Miguel Castillo Didier made an inventory (see Bibliography) and conducted a series of studies. Pablo Castellanos organized the Young Organists Festival in Mérida (1978–85). The six surviving Cavaillé-Coll organs were declared a national cultural heritage in 1981. Three of these were restored by Kleuker (1983); the other three were restored by the author (1986). During the last decade of the twentieth century, several positives were imported, among them two Oberlinger instruments. Jorge Sánchez gave recitals and created the radio program *Organs and Organists* in 1995.

The most recent inventory revealed a total of fifty-six organs in Venezuela: twenty-eight in Caracas, five in Maracaibo, and twenty-three in the countryside. Many of them are French and German instruments. Their size ranges from four-stop portatives to 2/28 organs. The biggest is the organ at Tucupita Cathedral (2/40). History has shown that due to climate, termites, and abandonment, pipe organs need frequent and costly repairs and do not last for a long time. Only four pre-1870 organs survive, all in very poor condition. Organ culture is scarce in Venezuela despite many quality instruments and the efforts of the twentieth-century organists, Miguel Angel Calcaño, Evencio Castellanos, Pablo Castellanos (pupil of André Fleury and Jean Langlais), Juan Bautista Plaza, and Jorge Sanchez

(pupil of Oliver Latry and Gaston Litaize). There is no organ in a concert hall. No organ works from the sixteenth to the mid-nineteenth centuries have survived. Excepting the works of Francisco Rodrigo (b. 1938), late-nineteenth- and twentieth-century compositions for organ show strong Romantic influence.
See also **Central and South America**

ANDRÉS GUNTER

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VENTIL

(Ger., Fr., valve.) A valve or pallet that admits or shuts off wind to a CHEST or STOP. In Baroque Spanish and nineteenth-century French organ building, the stop valve (*Sperrventil*) controlled the airflow to individual chests, which could be brought on immediately by means of a pedal. The pneumatic stop valve also redirected wind to other chests or to prevent ciphers.

Ventil chests (*Registerkanzellenlade*, STOP-CHANNEL chest) are those that, instead of using a SLIDER to open or close a stop (RANK), open or close the notes associated with one pitch, using a spring-loaded wire with a disc valve for each note. When a key is depressed, and a particular stop channel has been drawn on and is being winded, the corresponding note will sound. *Kegelladen* (cone-chests) are a type of ventil chest. Aristide CAVAILLÉ-COLL, William E. HASKELL, and Hilborne L. ROOSEVELT used different pneumatic and electro-pneumatic ACTIONS in conjunction with a ventil chest, and experimented with combination action–type ventil devices. Electrification of slider-chests and electronics spelled the end of the "older" ventil chests with their distinctive-sounding winding action.
See also **Bellows; Windchest**

RICHARD KASSEL

VERSCHUEREN

Dutch organ-building family. Léon I (Leonard Hubert) Verschueren (1866–1957) worked as a pipemaker for MAARSCHALKERWEERD in Utrecht (1886–90), then opened a workshop for pipes and parts in Heythuysenhad (Limburg), supplying more than thirty builders. He built his first new organ for Schagen, Reformed Church (1896; mech.; lost). He then worked with a German builder, Max Bittner, from 1904 to 1955; this encouraged a blending of southern Netherlandish and German styles of the late Romantic era (Gulpen, St. Peter's, 1929; pneum.).

As a result of studying the 1932 KLAIS organ at Kerkrade, Rolduc Abbey (3/42), a product of the ORGAN REFORM MOVEMENT, Léon I changed his design for Schinnen, St. Dyonisius (1933–34; 2/25; extant). The result was a typically eclectic neobaroque organ, with a Swell division, cone-chests, and electro-pneumatic action. His magnum opus of this period was built for Eindhoven, St. Cathrien (1936; rest. 1990), featuring main (four manuals) and chancel (two manuals) consoles. Both keyboards are capable of playing all seventy-seven stops of this electro-pneumatic instrument, considered the most important of the Dutch organ reform movement. It remained the model for Verschueren's designs into the 1950s.

Léon I's four sons went into different facets of the organ-building world. Léon II (Gerard Joseph) Verschueren (1903–1986) became director of the Verschueren firm in 1957. Frans (Joseph Jacques) Verschueren (1914–1986), who trained with KUHN in Männedorf, Switzerland, headed the pipe and voicing departments. Ton (Antoine Henri Joseph) Verschueren (1911–1972) served as administrator (from 1946 on). (George) Emile Verschueren (1909–1985) headed a branch in Tongeren, Belgium (from 1937 on); this branch became independent after 1951, remaining in business until 1998. Léon III (Leonard Francis Maria) Verschueren (b. 1947), the son of Frans Verscheuren, became director in 1977.

The end of World War II brought exports of Verschueren organs to the United States and Japan, many still using electro-pneumatic action. The firm began building Rugpositief divisions in 1948, then organs with mechanical actions (1953). As tracker organs were produced in increasing numbers, electro-pneumatic organs were gradually dropped from Verschueren's production. A few experiments with unit organs were made (Klazienaveen, Reformed, 1963; 2/14 from three foundation registers), but this organ was replaced by a more typical Verschueren (1971; 2/17, mech.). The firm developed a reputation as a builder of one- and two-manual mechanical organs; foot- or hand-operated winding options are usually included.

Another shift in philosophy occurred after the 1969 Groningen Schnitger conference; like many other firms, Verschueren decided to pursue a more "historically informed" path, often using specific instruments as models. Even its organ cases, which had followed either recent (late Romantic) or modernist (unencased) lines, became more historically designed. An example is found at Wouw, Lambertuskerk (1984; 2/22), emulating Dutch Baroque style. Subsequently, the firm expanded its range of models to include northern Dutch style and the nineteenth century. In 1991, the Netherlands' Queen Beatrix named Verschueren *Hofleverancier* (supplier to the court).

Since the mid-1980s, Verschueren's international reputation has grown significantly, while continuing building for the Dutch market. By 2002, instruments had been installed in Austria, Belgium, Finland, Italy, Germany, Norway, and Sweden. The most significant of these is at Göteborg, Sweden, Göteborg University (1998; 3/43), built in the style of Charles Mutin for use by the Göteborg Organ Art Center. Other installations of the period are Roggel, St. Peter (1998; 2/19) and Utrecht, Tuindorpkerk (2000; 2/28).

Restorations have been an important part of Verschueren's work since the 1970s. Highlights include Gronsveld, St. Martin (1711 Le Picard organ, 1974; 3/25); Helmond, St. Lambertus (1772 Robustelly/1861 Smits organ, 1974–75; 3/47); Cuijk aan de Maas, St. Martin (reconstr. 1650 Severijn organ, 1992; 3/33); Leiden, Pieterskerk (1518 van Covelens/1643 van Hagerbeer organ, 1994–98; 3/36); Kempen, Germany, Paterskirche (reb. 1752 L. Koenig organ, 2000; 2/28); Amsterdam, Nicolaaskerk (1889 Sauer organ, 2001; 3/39; cone-chests, Barker lever); Haarlem, St. Bavo Cathedral (eighteenth-century G. David choir organ, 2001; 1/11/pull-down); Ferwent, Reformed (1872 Adema organ, 2001; 3/34); and Escharen, St. Lambert (rest. 1700 Brammertz/1843 F.C. Smits I organ, 2002–03; 1/10/pull-down).

Richard Kassel

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VERSET

See Alternatim

VIOL/VIOLE

(1) An imitative String stop of incisive quality, usually 8' on the manual, 16' on the pedal.

(2) More commonly, a colorful family of flue stops, usually wood, imitative or unimitative, narrow-scaled with a relatively weak fundamental and strong representation of higher partials (up to the sixtieth in some cases) The resulting dissonances produce the brilliant, cutting effect of this family, even in softer ranks. While effective in contrapuntal contexts, Viols (and Strings in general) are difficult to blend harmonically, and appear in lesser proportion to the Flutes and Diapasons on main divisions, although they can help to ease a certain weariness of "harmonic purity" in other stops. Viols began appearing in the early nineteenth century; eventually, larger organs had a separate, wholly autonomous String division, bolstered by a few Flutes to soften the effect of a String chorus. The term *Viole* (sometimes *Viola*) is found in conjunction with *d'Amore*, *da Gamba*, *d'Orchestre* (the true orchestral violin), *Phonon*, and *Pomposa*, among others.
See also **Stop**

VIOLA

(1) A narrow-scaled imitative String stop of 16', 8' or 4' pitch; effective as a chorus and a bit less brilliant than most strings, it is nonetheless pungent and effective as an accompaniment. It is the true orchestral viola.

(2) From about 1750, a Regal in Italy and Spain, also called Violetta or Violeta; often horizontal in Spain.
See also **Stop; Viol/Viole**

VIOLA DA GAMBA

An imitative 8' String manual stop (sometimes 16' on the pedal), sometimes made of tin (producing a more pungent sound); from the Baroque on.

VIOLA D'AMORE/VIOLE D'AMOUR

A small-scaled soft-toned String stop of 8' or 4' pitch, voiced to resemble the tones of the string instrument of the same name. Its open metal pipes are usually cylindrical with harmonic bridges, but are sometimes conical and may have a slotted bell. The tone of this stop has been described as sweet, refined, reedy, and sharp. It dates from the early 1700s. Also called Liebesgeige.
See also **Stop**

Edward L. Stauff

VIOLA POMPOSA

An 8' String stop of strong and broad tone. According to Williams, it was developed in the 1930s by G. Donald Harrison. Ernest M. Skinner, who employed Harrison, called the Viola Pomposa "a string stop of the time of Bach; of little account according to present day standards." Skinner's remark, written much later

in the century, may have been influenced by his earlier falling out with Harrison over tonal issues.
See also **Stop**

EDWARD L. STAUFF

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VIOLIN DIAPASON

SEE GEIGEN/VIOLIN DIAPASON

VIOLONCELLO/CELLO

(1) An imitative String stop of 16' or 8' (manuals and pedal) or 32' (pedal). Less narrow and stronger than other strings, it is a powerful solo stop that can overwhelm similar stops in divisions other than its own.

(2) In the late eighteenth century, a small wood Regal, often the sole reed in Venetian organs; later short cylindrical metal pipes (Serassi).
See also **Stop**

VIOLONE

A nonimitative String stop, most commonly a pedal bass (16' or 32'), less often on the manuals (8' or 16'); considered a Diapason hybrid, louder and stringier, yet less pungent than orchestral strings; from the seventeenth century on (named for the bass viol, now obsolete).
See also **Stop**

VIRDUNG, SEBASTIAN (B. 1465; D. AFTER 1511)

German theorist. Virdung was the son of a well-to-do citizen of Amsberg, where he was born. He studied at the University of Heidelberg and received musical training at the Hoftkantorei. He became a priest and obtained several prebends. For a short while he worked in Konstanz, where he was dismissed for being unable to train the choir.

In 1511 his *Musica getutscht und ausgezogen* was published in Basel. Here Virdung discusses musical instruments and their notation. The classification is rather inconsistent. He also challenges Arnolt SCHLICK, a former colleague, who responded with his SPIEGEL DER ORGELMACHER. As the oldest printed treatise on instruments of music, *Musica getutscht* was translated into Latin (1518/1536), French (1529, according to van der Straeten) and Flemish (1568).

FERDINAND J. DE HEN

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VISSER-ROWLAND

American organ-building firm. It was founded by Pieter A. Visser (b. 1940), and Jan R. Rowland (b. 1944) in 1973; Rowland left the company in 1986. The firm later took the name of Visser and Associates and had built over 130 organs by the close of 2003. The Visser firms have built primarily freestanding encased tracker organs of all sizes based on Netherlandish traditions, as well as a few having electric key action; approximately half use electric stop action. The company philosophy

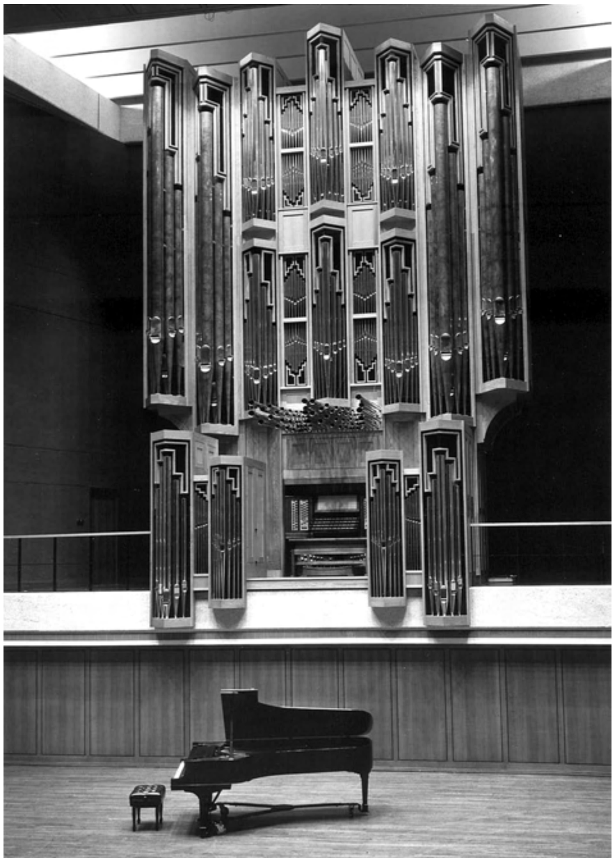

Fig. 76. Visser-Rowland organ, 1983 (4/97), University of Texas, Austin.

is moderate in tonal and conceptual design; a strong historical influence is combined with a modern architectural emphasis. Relatively stable wind is delivered by a number of systems. The pipes of manual divisions are arranged in a major-third layout for stability of tuning. Two-manual organs typically have a third coupler manual. Among the firm's prominent tracker installations are at San Antonio, Texas, St. Luke's Episcopal (1982; 4/71); University of Texas–Austin (1983; 4/97); and Eden Prairie, Minnesota, Wooddale Church, (1991; 5/114). The firm is located in Magnolia, Texas.

ARTHUR LAWRENCE

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VITRUVIUS [MARCUS VITRUVIUS POLLIO] (CA. 84 BCE–CA. 14 BCE)

Roman technical writer and architect, possibly born in Formiae (now Formia, Italy). He describes the HYDRAULIS in his *De Architectura*. In the preface to book 7, Vitruvius implies that he is working from a copy of CTESIBIUS's *Commentaries* (lost). But the details he provides about the external appearance of the instrument, with its ornamental bronze dolphins, suggest that he had also witnessed a hydraulis firsthand. Although very brief and obscure in places, Vitruvius's account gives information about the three primary parts of the hydraulis: the blowing mechanism, the WINDCHEST, and the KEY mechanism. Two bronze cylinders containing pumps are located at either side of a water cistern that stabilizes the WIND PRESSURE. The pumps push the trapped air into an air container, shaped like an inverted funnel, which rests in the water cistern. The water in the cistern stabilizes the wind pressure as the compressed air moves into the pipes. (If the organ-blowers pumped their cylinders alternately, one would fill with air as the other emptied, and the water level in the cistern would not vary significantly.) Vitruvius gives the earliest indication of a windchest with channels that can be opened or closed, allowing the organist to separate individual RANKS of pipes. The number of ranks on the hydraulis CHEST is either four (tetrachordal), six, (hexachordal), or eight (octochordal). SLIDERS located between the channels and the RACKBOARD are perforated with holes corresponding to the number of pipes for each note of the organ. When the slider is pushed in, its holes align with those of the top board and the pipes sound. Keys cause the sliders to move when pressed by the organist, and iron springs attached to the keys return the sliders to their original position, blocking the flow of wind to the pipes. Unfortunately, Vitruvius does not include details about the organ pipes, although he specifies that loud sounds and a variety of musical effects were produced by the hydraulis.

KIMBERLY MARSHALL

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VLEUGELS

German organ-building firm. In 1958, organbuilder Hans-Theodor Vleugels (b. Aachen, 1931) formed his business by combining three smaller organ-building firms that had been operating in Hardheim. While

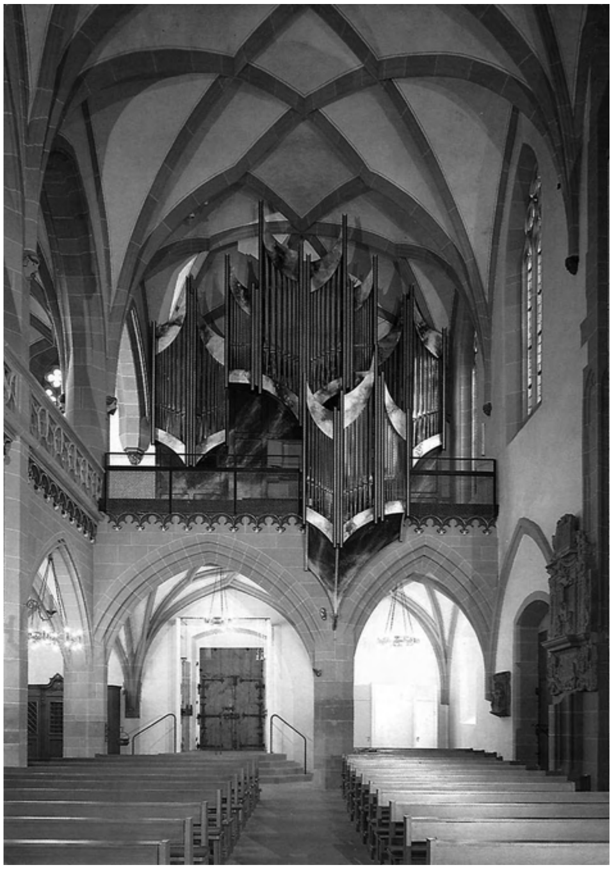

Fig. 77. Vleugels organ, 1996 (3/54), Stadtpfarrkirche St. Johannes, Kitzingen, Germany.

following traditional south German models, the company initially built instruments incorporating modern technologies such as electric stop action. Cases had very contemporary designs, such as the organ in Cologne-Gremberg, set on a mushroom-shaped concrete pedestal, or in another organ that has a free hanging steel frame with plexiglass used for the swell box and rollerboards, thus enabling a free view into the workings of the instrument.

During the 1970s the firm abandoned the use of tropical woods and laminates in favor of solid woods, and electric ACTION likewise was discarded in favor of mechanical action. While continuting to build new organs in the 1980s the firm began to devote attention to the restoration of older instruments, including organs of the South German Baroque, and Romantic instruments with valve chests and pneumatic actions. In 1988 the company moved into a new large, open, and modern shop; that same year, Hans-Georg Vleugels (b. Stuttgart, 1958) became director of the firm. Computer-assisted design is now employed extensively.

Developments during the 1990s included the restoration of several important concert hall organs: Görlitz, Stadthalle (1910 Sauer organ; 1991; 4/71); Heidelberg, Stadthalle (4/56); and Prague, Smetana-Saal (1912 Voit und Söhne; 1995–96; 3/70). The construction of new large instruments in a late-nineteenth-century style was also completed at Aschaffenburg, Herz-Jesu Kirche (1995; 4/63); Munich, Bürgersallkirche (1994; 3/50); Kitzinger, Stadtpfarrkirche St. Johannes (1996; 3/54); and Jülich, Probsteikirche (1998; 3/45). The Jülich organ contains accessories including thunder rolls, rain machine, and a croaking bullfrog. Vleugels also built new organs in the South German style in historic cases at Würzburg, Käppele (1991; 2/31) and Schäftlarn Benediktinerabtei (1996; 2/31). There were new directions in constructing cases using special materials—a glass case for the Christopherus-Kapelle of the Franz-Josef-Strauss airport in Munich (1/6)—and dramatic artistic effects with contemporary painting as in Kitzingen, Stadtpfarrkirche St. Johannes (1996; 3/54) and Runding, St. Andreas (1998, 2/36). Finally, the 1990s saw the restoration of several historic organs in Germany: Gaibach, Heilig-Kreuz-Kapelle (1699 Schleich organ; 1989–90; 1/7); Gaibach, Pfarrkirche (1748 Seuffert organ; 1997; 1/12); Mainz Budenheim, 1747 Kohlhaas organ; and Laumersheim in der Pfalz (1717 Hoffmann organ).

DOUGLAS E. BUSH

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VOCALION

A large free-reed organ utilizing broad, high-pressure reeds furnished with individual resonance chambers or qualifying tubes and actuated by interior pressure. Its invention is generally attributed to the Scottish inventor James BAILLIE-HAMILTON, although he was materially aided by others. The ranks of contiguous tubes were either placed vertically, as in the smaller instruments, or horizontally one above the other, in the larger organs. The cases were necessarily large to accommodate the reeds and resonators, which were wider than the keys, in contrast to the common REED ORGAN. The combination of these elements resulted in a pipe organ–like tonal quality of a stability and power far exceeding that of the ordinary reed organ. In the light of the superior tonal quality of the instruments and the excellent design and workmanship employed in them, the Vocalion may have well been the highest level of development attained by the reed organ. In its final form, it was made in many sizes and styles, from single-manual models with four sets of reeds to large instruments of three manuals and pedal.

Through the end of the nineteenth century, Hamilton entered into several business arrangements in Canada, England, and the United States in many attempts to manufacture the Vocalion, most ending poorly. In one of his last arrangements, the Munroe Organ-Reed Company, supplier of reeds and organettes to the industry, leased factory space to Vocalion and may have manufactured reeds for its use. Munroe was purchased by the ÆOLIAN COMPANY. In 1903 the Vocalion firm was acquired by the Æolian Company, along with numerous other piano and organ firms. Although production of the Vocalion ceased shortly afterward, the company introduced the Orchestrelle, a large player organ utilizing reeds and resonators built along Vocalion lines. It was built in at least sixteen different styles and sizes between 1900 and about 1920.

JAMES HOWARD RICHARDS

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VOGELSANG/NACHTIGALL/ROSSIGNOL

A range of different novelty stops, all of which imitate birdsong. Revived in the twentieth century on theater organs, they were also popular in Europe from about 1450 until 1800. The organ of Toulouse Cathedral in 1530 had both birdsong and a tambourine (Sumner). They were also popular on secular instruments, such as Italian water organs.

Construction varied according to the particular bird being imitated. The simplest variants partly submerge pipes in water to produce a twittering effect. Mineral oil is now used, as it does not evaporate. Other types use pipes a third apart to create the illusions of a cuckoo. The stop name is also occasionally given to a glittery mixture or a high-pitched flute stop.

See also **Bird Whistle; Nightingale; Toy Stop**

Alastair Disley

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VOGLER, (ABBÉ) GEORG JOSEPH (1749–1814)

German organ designer, composer and theorist. Vogler studied law at the universities of Würzburg and Bamberg; he later traveled to Italy, where he studied music in Italy with, among others, Giovanni Battista (Padre) Martini in Bologna and Francesco Vallotti in Padua. Not yet twenty-five years old, he was named protonotary and chamberlain to Pope Clement XIV, who granted him also the Order of the Golden Spur. Returning to Germany, he started a career as a maestro di cappella in Mannheim and published several writings on the theory of music. His book on his “simplification system,” ready for publication, is lost (see below). Abbé Vogler also worked in Prague, Stockholm, and Vienna, where he met Ludwig von Beethoven, Franz Joseph Haydn, and the young Carl Maria von Weber. He composed numerous religious and secular compositions. He experimented with harmony, clusters (imitations of thunder), and melodrama (spoken music drama, then popular), and was interested in folk and non-European music, seeking the origins of Gregorian chant in Greek and Arab music.

As an organ designer, Vogler is best known for his simplification system, a method of reducing the number of pipes in an organ. He applied an acoustical phenomenon by which the difference between the frequencies of two related partials (specifically, the third minus the second partials) result in the frequency of their shared first partial (fundamental), albeit at a rather soft dynamic level. Doing so, he was able to reduce the number of large, costly organ pipes. He also encouraged the use of FREE REEDS rather than “striking” (LINGUAL) reeds; the arrangement of pipes in pitch order, rather than the usual symmetrical “bishop’s miter”; and using fewer mixtures and other multirank stops. By reducing the total number of stops to the most essential ones, Vogler anticipated the Romantic fondness for FOUNDATION STOPS. He also improved the winding process.

In 1789 Vogler built the ORCHESTRION, a portable organ (4/63) displaying his theories in practice, with only nine hundred pipes (reeds). Another of its novelties was the enclosure of the entire organ in a SWELL box, allowing for dynamic expression not often found in his day. He used it as a transportable concert organ during a European tour (1789–90).

Ferdinand J. De Hen

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VOGT, MAURITIUS (JOANNES GEORGIUS) (1669–1730)

Bohemian organbuilder and theorist of German origin. Born in Königshofen/Grabfeld, Bavaria, on 30 June 1669, he moved to Bohemia with his father, a surveyor and cartographer, and began studies in theology and philosophy in Prague. In 1692 he entered the Cistercian monastery at Plasy, where he studied music and was subsequently ordained a priest in 1698. Vogt authored several books (*Tilia Plassensis*, a history of the Plasy monastery, 1712; *Das jetzt lebende Königreich Böhmen*, 1712; and *Moravia subterranea*, 1729) and published maps in Nürnberg. His most important publication, *Conclave thesauri magnae artis musicae* (1719), a complete compendium of music with special attention given to the organ, includes four sections dealing with organ contracts, organ history, the building of a large one-hundred-stop organ, and the examination of an organ. The *Conclave* also provides a summary of thirty-six rules concerning harmonic theory, and he gives an interesting overview of the doctrine of affections and figures.

As a monk Vogt was active as an organist and composer, and served as the music director to Countess Marie Gabriela Latanská at Mantín from about 1711. In 1724 he became the superior of the pilgrimage church at Mariánská Týnice, near Kralovice, where he died on 17 August 1730.

Douglas E. Bush

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VOICING

The set of operations needed to make a pipe sound match stop specifications. Local traditions have strongly influenced the aesthetic choices made by individual organbuilders. The pipes—both FLUE and REED—have to be correctly built, using good quality materials, to be easily voiced. For the flue pipes, the sharper the borders of the mouth elements (upper and lower lips and languid), the richer in partials the sound. Therefore the organbuilder limits a few or more partials to get a sound closer to the stop's specifications. To correctly do that, the builder uses a set of tiny tools of various shapes to make little, unsharpened cuts in the pipe's mouth (NICKING).

Essentially, the character of the sound of a PIPE, when accurately built, depends on (1) the scaling (the comparative sizes—ratios—of the parts of the pipes); (2) the correct reciprocal position of the MOUTH elements as well as of the dimension of the wind channel (also called the flue) and of the opening in the pipe FOOT; and (3) the way in which the sharpness of the LIP and LANGUID borders are smoothed.

The flue pipes can be smaller or wider in size, in comparison with the usual principal "scale." The smaller the pipe diameter, the more nasal the sound, and vice versa. Very narrow-scaled pipes are difficult to voice, so when flue stops imitating stringed instruments were first introduced, a BEARD, a rounded piece of metal attached between the pipe's EARS or a bar connecting the lower ends of the ears, helped to stabilize the tone by forcing wind coming out of the flue to strike the upper lip border correctly. For metal pipes, a small piece of metal also could be soldered onto a wire in front of the upper lip. In the second half of the nineteenth century, this device was replaced by the harmonic bridge, an adjustable beard attached below the pipe mouth. In wooden pipes, a protruding border joint framing the mouth's contour served the same function.

The height of the flue must be accurately controlled in respect to the reciprocal position of the lip borders. The WINDWAY must be thinned or widened to create the desired sound, the opening in the foot of a pipe made smaller if the pipe emits a sound louder than required. There are two ways of adjusting the foothole: (1) open-toe voicing, in which low wind comes directly to the flue; and (2) refined foothole voicing, which varies its diameter according to WIND PRESSURE. The languid border must be vertically aligned with the

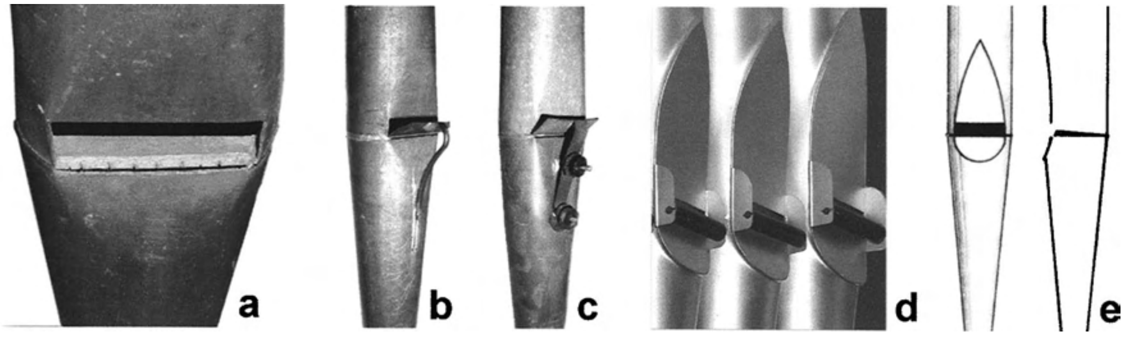

Fig. 78. Voicing: a) front view of metal flue pipe mouth, showing upper lip, languid, and lower lip; b) beard or harmonic bridge, side view; c) beard, three-quarters view; d) ears with beards attached on bottom, or boxbeards, three-quarters view; e) diagram of pipe mouth, front and side views.

lower lip to get an Italian Principal-like sound and put a bit farther out to get a Flutelike sound.

The so-called teeth (notches) can be cut into the languid border to further regulate the intensity of the partials and to dull the inharmonic sounds. The notches are usually tiny or absent in the older pipes, but deeper and rougher in the pipes from the end of the nineteenth century onward or in those retouched by less competent organbuilders. It is better not to use a slot on the top of the pipe to get a very accurate voicing, but instead cutting the length of the pipe at the top (Antonio Barcotto, *Regola, e breve raccordo*, 1652), inserting little wooden doors around the pipe border, and adjusting these to correct the pipe intonation.

MARCO TIELLA

VOIT

German organ-building family. There were two Voit branches, one in Schweinfurt, the other in Durlach, near Karlsruhe. The Schweinfurt branch was founded by Johann Rudolf Voit (b. 28 Apr. 1695; d. Schweinfurt, 13 Jan 1768). He learned carpentry from his father (1710–13) and by 1719 had achieved the status of a "master," but it is unknown as to how he became an organbuilder. Altogether he married five times, and had the reputation of an experienced artisan in organ building. All his known instruments are one-manual organs with between eight and fifteen stops. Representative instruments are at Altenschönbach (1728; 1/8); Sennfeld (1730; 1/11); Rügheim (1740; 1/10); Ermershausen (1747; 1/9); Burgpreppach (1752; 1/10); Abtswind (1756; 1/15); Fischbach (1761; 1/8); and Gollhofen (1766; 1/12). Johann Michael Voit (b. Schweinfurt, 7 Nov 1744; d. there, 27 Aug 1819), son and student of Johann Rudolf Voit, took over his father's workshop in 1768. A prominent citizen, he generally carried on the organ-building style and approach of his father. His organs include Albertshofen (1771, 1/13); Escherndorf (1776, 1/10); Schweinfurt, Salvator Kirche (1780, 1/11); Helmershausen (1786, 2/26); Wetzhausen (1791, 1/13); Kleinlangheim (1801, 1/13); and Ippesheim (1807, 1/11).

Carl Friedrich Voit (b. Schweinfurt, 4 May 1774; d. there, 20 Mar 1854), son and student of Johann Michael Voit, worked in the family business, which changed its name to Johann Michael Voit und Söhne in 1810. Following his father's death he took over direction of the company. After 1800 the firm expanded its operation to include building clavichords and the Hammerflügel (piano); they enjoyed considerable success—one Hammerklavier from 1804 is labeled number 325—but other than a few repairs and rebuilds, none of their instruments survive. Johann Christian Voit (b. Schweinfurt, 5 Sept 1784; d. there, 28 Nov 1841), another son and student of Johann Michael, did not work as an independent organbuilder, working in the family business as he pursued other professional interests.

Johann Volkmar Voit (b. Schweinfurt, 1 June 1772; d. Durlach, 29 Jan 1806), Johann Michael's oldest son and student, went to work in 1794 in Durlach for a firm founded by Johann Heinrich Stein (1735–1767) of Heidelsheim (1764), then continued on by his cousin Georg Markus Stein (1738–1794), organbuilder to the court of Baden-Durlach. After Stein's death Johann Volkmar married Stein's daughter and became his successor, thus founding the Durlach family branch of organbuilders. Johann Volkmar Voit was named court organbuilder in 1804. After his death, his widow married Johann Ludwig Bürgy (b. Niederflorstadt, 2 Aug 1761; d. Durlach, 31 Aug 1838), who ran the workshop until 1835. Bürgy trained his stepsons as organbuilders, as his own sons had died young. Louis Voit (b. Durlach, 20 Jan 1802; d. there, 16 Jan 1883), son of Johann Volkmar Voit and pupil of Bürgy, worked in the shop from 1828 and was its owner from 1835 until 1870. Under his direction it became one of the leading organ firms in Baden, with well over 400 instruments built under his supervision.

Heinrich Voit (b. Durlach, 18 Feb 1834; d. there, Oct 1914) and Carl Voit (b. Durlach, 1847; d. there, 16 Aug 1887), sons of Louis Voit who had received their training with the Förster firm in Lich, succeeded their father in the firm. In 1890, Heinrich's sons Emil Voit (b. Durlach, 10 Oct 1864; d. there, 12 Mar 1924) and Siegfried Voit (b. Durlach, 2 Sept 1870; d. there, 11 May 1938) became partners in H. Voit und Söhne, operating under this name into the 1920s, building about fifteen hundred organs. The firm had a fine reputation and had several patents for pneumatic and electric tracker actions to their credit. In 1930 Siegfried retired from the firm; a previous Voit associate and manager, Karl Hess (1879–1943), took over the directorship and continued the firm under the Voit name until 1938. Under the direction of Hess's widow, the firm continued until around 1959.

DOUGLAS E. BUSH

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VOTEY, EDWIN SCOTT

See Farrand and Votey

VOX ANGELICA/VOIX ANGELIQUE

The "voice of an angel," applied to the softest organ rank, an 8' manual stop of varying designs, including Dulciana, Echo, Flauto Dolce, Gamba, and Viola d'Amore. Color is less important than its pitch, which must be discernable; it is most effective as a soft accompaniment or as a "trick" stop to make sound "emerge" out of nothing, especially when placed in its own swell box (within a larger one); in use from the eighteenth century.

See also **Stop**

VOX HUMANA/VOIX HUMAINE/VOCE UMANA

In most cases, an attempt to imitate the "human voice" on the organ. Dating back to at least the late Renaissance, the most common form is a Regal (short resonator) stop; it is said to be the oldest "surviving" rank, in that it retains its original timbre. The most common of its many forms has been a metal cylindrical pipe with a short resonator (up to one-quarter length), partly or wholly stopped. The timbre is usually described as mysterious, somewhat thin in fundamental, tenuous and whisper-like; it affects any combination significantly. Its tremulant qualities are essential but must be kept under control. On theater organs, where it is highly characteristic, there may be separate Vox Humanas on the accompanimental, orchestral, and solo divisions. Historically, the Vox Humana represents a centuries-old attempt to capture the most essential musical sound; at its best, it approximates a distant choir; at its worst, it is comical if not downright distasteful. More than most stops, the Vox Humana depends on its acoustical environment: a large room with reverberation, distance from the congregation, and placement inside a swell enclosure can all contribute positively.

See also **Stop**

Richard Kassel

VULPEN, VAN

Dutch organ-building firm. Brothers Rijk van Vulpen I (b. 11 Apr 1921; d. 15 Oct 1997) and Adrianus (Jos) van Vulpen (b. 5 July 1922) founded their organ-building firm in Utrecht (1940), a year after building their first instrument. Their brother Evert (b. Utrecht, 1929) joined the company as an employee in 1952. Adrianus's son Rijk van Vulpen II (b. 3 Aug 1955) joined the firm in 1974. Rijk I retired in 1983, leaving Adrianus as sole proprietor. Rijk II took over the firm (now Gebr. van Vulpen BV) in 1997; by 1999, he was in partnership with Henk Bouwman (b. 1 Sept 1938).

The van Vulpen firm initially concentrated on smaller mechanical action instruments (Sellingen, Reformed, 1952, 1/6/pull-down; Amersfoort, Bergkerk, 1956, 2/18); later, its work was influenced by the eclectic neobaroque organs of Marcussen And Son (notably Utrecht, Nicolaïkerk, 1957, 3/33). The company became known internationally for its one- and two-manual instruments (Utrecht, Marcuskerk, 1961; 2/19); but expanded its horizons through organs such as Wassenaar, Bloemcamp Reformed, 1962 (3/24; to Gouda, 1992); Berghem, St. Willibrordus, 1965 (3/31); and Bremen, Germany (GE), St. Peter's Cathedral (1966; 3/36). As with other Dutch firms inspired by the 1969 Groningen Schnitger conference, van Vulpen began to construct its instruments (including pipes) more directly on pre-nineteenth-century models. The cases, however, ranged from historical to modernist. Among the results were new instruments at Krefeld-Uerdingen (GE), Michaelskerk (1972; 3/30); Recklinghausen (GE), St. Elizabeth (1975; 3/39); Woerden, Maranathakerk (1983; 2/18); Ede, Taborkerk (1986; 2/16); Valestrand, Norway (1987; 1/11); Zuidhorn, Reformed Church "de Rank" (1989; 2/25), Ouddorp, Dutch Reformed (1995; 3/38); and Meerkerk, Ichthuskerk (2001; 2/13). The firm also offers standardized instruments.

Van Vulpen is probably best known for its restoration of Dutch organs, including Leens, Petruskerk (1734 Hinsz organ; 1963–67; 2/27); Brouwershaven, St. Nicholas Cathedral (new organ in 1557 Niehoff case; 1968, 1980; 2/19/pull-down); Peize, Reformed (1631 A. Verbeek/1697 A. Schnitger/1758 A. A. Hinsz organ; 1969; 2/22; orig. Groningen, St. Geertruidsgasthuis; moved 1862); Utrecht, Cathedral (1571 P. J. de Swart/1831 J. Bätz organ; 1975; 3/50); Nijkerk, Cathedral (1756 M. van Deventer organ; 1975–87; 2/23); Vollenhove, Cathedral (1686 A. Bosch/1720 F. C. Schnitger I/1860 van Loo organ; 1977; 2/25); Hendrik-Ido-Ambacht, Reformed (reconstr. 1696 J. Duyschot organ; 1982; 2/20; orig. Delft, Waalse Kerk; moved 1900); Haarlem, Nieuwe Kerk (1523 van Covelens/1791 H. H. Hess organ; 1985–94; 2/21); The Hague, Council of State, Gothic Room (1842 J. Bätz organ; 1990; 2/18); Kampen, Broederkerk (reb. 1738 A. A. Hinsz organ; 1993; 3/31); Utrecht, Evangelical Lutheran (1880 J. F. Witte organ; 1998; 2/14); and Mijdrecht, Reformed (1842 J. Bätz organ; 2001; 2/16).

Richard Kassel

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W

WAGNER, JOACHIM (1690–1749)

Prussian organbuilder. The details of Wagner's apprenticeship are uncertain. His instruments betray style features from a number of regions, including Saxony (mounted cornets), Thuringia (Mixtures with thirds), and northern Germany (complete Pedal divisions). From 1721 until his death he completed some thirty-five organs (including eight three-manual instruments); among those at least partly extant are Berlin, Marienkirche, 1723, 3/40; reconstr. Kern, 2000–01; 3/45); Brandenburg, Cathedral, 1725; Bad Freienwalde, St. Nikolai, 1728; Stargard/Pomerania, St. Johannis, 1731; Jüterbog, Liebfrauenkirche, 1737; Trondheim, Norway, Nidaros Cathedral, 1739–41; 2/30; rest. Ahrend, 1993–94); Angermünde, St. Marien, 1744; and Salzwedel, St. Marien, 1749.

In 1726 the organist of the Alte Garnisonkirche in Berlin, J. F. Walther, published a description of the individual stops of the organ that Wagner completed for the church in that same year (3/50), a description with many registration indications (see Steves). Johann Sebastian Bach played several of Wagner's organs in 1747, when he visited the court of Frederick the Great in Potsdam. Wagner was the most significant organbuilder in Prussia during the eighteenth century.

Quentin Faulkner

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WAGNER, JOHANN MICHAEL

German organbuilder. There is some dispute concerning Wagner's dates of birth and death; one view is that he was born in 1727 and died in 1801; others believe that he was born around 1720 and died sometime after 1789, in connection with the French Revolution. Wagner collaborated with Johann Caspar Beck and others on an organ for Laubach, Stadtpfarrkirche (1747). He also worked with his brother Johann Christoph Wagner (ca. 1725–after 1770) on a number of instruments.

Wagner built instruments for Suhl, St. Marien (1762; 2/29; rest. Schönefeld, ca. 1975); Arnheim, Groote Kerk; and Dresden, Kreuzkirche (1789, destr. 1897). A typical Wagner organ had a Rococo case, a strong Hauptwerk, an Oberwerk with mainly Flute stops and reeds, and a Pedal with several 16' stops. Although there was little change in the Wagner style over time, improvements in the windtrunk by dividing the wind between chests proved important and influenced other builders.

Ferdinand J. De Hen

WALCKER

German organbuilding family, active for seven generations. Johann Eberhard Walcker (1756–1843), who studied with Johann Georg Fries in Heilbronn, established an organbuilding shop in Cannstatt in 1780. His most

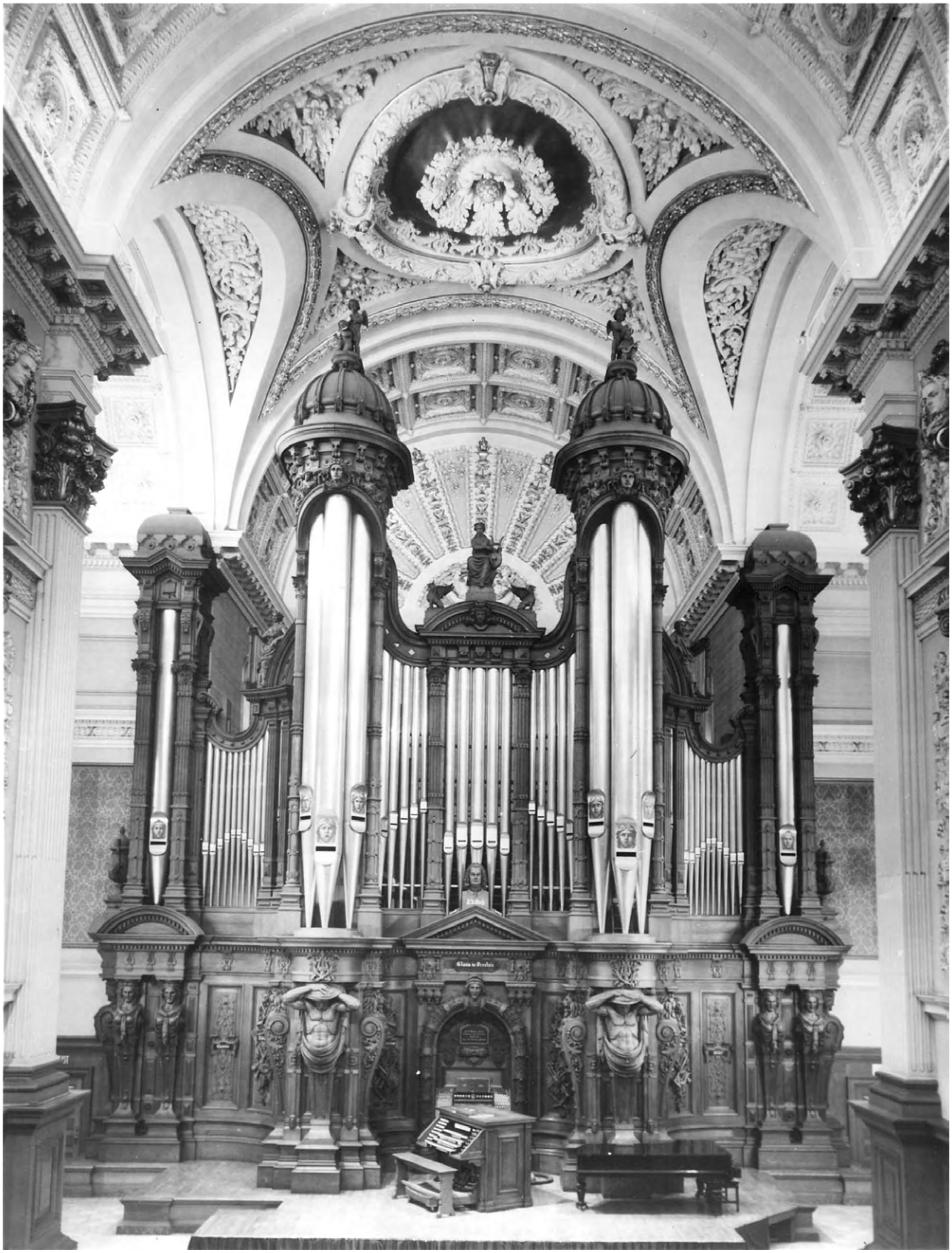

Fig. 79. Walcker/Æeolian-Skinner organ, 1863/1947 (4/84), Methuen Memorial Music Hall, Methuen, Massachusetts.

important organs were built for Ludwigburg, Garrisonkirche (1782) and Cannstatt, Stadtkirche (1794). His son Eberhard Friedrich Walcker (1794–1872) moved the firm to Ludwigsburg in 1820, where it became E. F. Walcker Orgelbau. The firm excelled in building large instruments, producing one (influenced by Georg Joseph VOGLER) for Frankfurt am Main, St. Paul's (1833, 4/74; destr. during World War II), and some for other German cities, as well as St. Petersburg. In 1840, he invented the cone-chest, which led to the manufacture of stop-channel ventil windchests. He worked to make wind supplies more stable and developed a form of rollschweller. He built an assembly room large enough to permit the erection of large instruments before they were shipped to their final destinations. A few large organs were built with double pedalboards. Perhaps the most important mid-nineteenth-century organ was built for the Boston Music Hall (1863; 4/89) at a cost of $60,000; although it did not last long at its original location, it had significant influence on American organbuilders; it is now housed in the Methuen, Massachusetts, Memorial Music Hall (reb. 1947 by Æolian-Skinner, directed by G. Donald Harrison).

After Eberhard Friedrich's death, his four sons—Fritz Walcker, Heinrich Walcker, Karl Walcker, and Paul Walcker—took over the management. Noted installations of this period included Vienna, Votive Church (1878; 4/61); Riga Cathedral (1883; 4/124, largest organ in the world); Vienna, St. Stephen's Cathedral (1886; 3/90); and Ulm Munster (reb. 1857 4/100 Walcker organ, 4/100; 1899; 3/109). Because of a disagreement, Paul left in 1892 to join Wilhelm Sauer's firm, eventually becoming its manager and, finally, owner (1910).

Oscar Walcker (1869–1948), son of Fritz Walcker, assumed control at the beginning of the twentieth century. After collaborating with Max Reger on the design of an organ for Munich, Odeon Hall (1906; 3/62), he came under the influence of Albert SCHWEITZER's Alsatian reform movement, advocating a return to earlier ideals and rejecting orchestral "imitations." The first Walcker reform instrument was for Dortmund, St. Reinold's (1909; 5/105). In 1917, he succeeded Paul Walcker as manager of the Sauer firm, administering both companies at the same time. With Wilibald GURLITT he built the so-called Praetorius Organ, based on Michael PRAETORIUS's 1619 *Syntagma musicum* treatise, for the musicology department of the University of Freiburg (1921; 2/19; destr. World War II). Other significant installations during Oscar's tenure were for the Stockholm City Hall (1925; 4/115); the Barcelona International Exposition (1929; 5/154); and Nürnberg, Congress Hall (1936; 5/220).

Werner Walcker-Mayer (1923–2000), a grandson of Oscar Walcker who apprenticed with Sauer, took over E. F. Walcker in 1948. Under his direction, more than three thousand organs had been built by the 1980s, including many for the United States. Among the notable instruments from this period are São Paulo, S. Bento Monastery (1954; 4/76); Budapest, Liszt Conservatory (1967; 4/86); Vienna, Gesellschaft der Musikfreunde (1968; 4/100); University of Wyoming (1972; 3/40); Salzburg, Mozarteum (1979; 3/41); New York, St. Luke's Lutheran (1990; 2/23); and Evansville, Indiana, Methodist Temple (1991; 3/56). The firm moved to Murrhardt in 1974, then to Hanweiler, Saarland, in 1986. Meanwhile, Sauer Orgelbau had been nationalized in 1972 but was turned over to Walcker-Mayer when it was renationalized; he built a new factory for it (Müllrose, 1994).

Walcker-Mayer was an important scholar and publisher; he worked with Gurlitt to build a new "Praetorius Organ" in 1955, somewhat closer to the Baroque writer's intentions (as then understood). He established the Walcker-Stiftung für Orgelwissenschaftliche Forschung in 1965, and published under the imprint Musikwissenschaftlichen Verlags GmbH. In addition to the Walcker house bulletins and books of other authors, he published *Die Gestaltung des Orgelspieltisches* (1968) and *Die römische Orgel von Aquincum* (1972). Four of his sons—Gerhard, Helmut, Klaus, and Michael—began working for the company toward the close of the twentieth century. Organbuilding activity ceased when both E. F. Walcker and Sauer Orgelbau became insolvent in 1999, however; the last project was the restoration of the Voit organ in Mannheim, Lutheran Church. The firm was dissolved in 2002. During its 220-year history, Walcker was one of the most influential German builders, installing nearly six thousand instruments throughout continental Europe, and in Asia; North, Central, and South America; the British Isles; and Russia. Its informative and diverse website continues to be maintained by Gerhard Walcker-Mayer.

ARTHUR LAWRENCE

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WALDFLÖTE

An open, large-scale, conical wooden "forest Flute" at 8', 4', and 2' pitch, limited to the manuals; pipes are square or rectangular, with usually inverted mouths whose location determines overall tone (bright versus harmonically rich). The Baroque 2' Waldflöte was often made of metal. A hornlike, moderately loud stop, the Waldflöte is an effective, penetrating solo rank.

WALDHORN

Most often, a reed stop of 16' or 8' pitch. As such it was mentioned by Jacob ADLUNG (1768), developed by Henry WILLIS (1875), and perfected by John H. COMPTON, who gave it a powerful and free tone. The term *Waldhorn* was subsequently used by the KIMBALL firm for a powerful flue stop. Prior to Compton's invention it was used as a synonym for a Waldflöte of 4' or 2' pitch, and also for an 8' reed intended to imitate the hunting horn.

See also **Stop**

EDWARD L. STAUFF

WALKER

English organ-building company. Joseph William Walker (1803–1870) apprenticed initially to George PIKE ENGLAND, but after England's death in 1816 he worked for England's brother-in-law, W. A. Nicholls, who died in 1820. Walker took over the London-based workshop, relocating it and forming his own company (1828). He began as an organbuilder and piano seller, but the latter business was dropped as his organ business thrived. He moved once more in 1837, to a third Greater London location, where the firm would remain until 1925 (surviving an 1847 fire). J. W. Walker died in 1870 a wealthy man; his son James John Walker (1846–1922) took over the firm (now J. W. Walker and Sons), and led it until his death; he was succeeded by four sons. By 1975, the company was being directed by Robert Pennells, who moved the firm to Brandon (Thetford Forest, Suffolk). In 1994, he turned the firm over to Andrew Pennells (1962–1999), whose early death required Robert to resume the chairmanship of the company.

Joseph Walker manufactured generally modest pipe organs as well as barrel organs. His conservative instruments, placed in neogothic cases, used the Diapason chorus as their tonal focus. This continuation of an eighteenth-century practice gave Walker instruments their true "Englishness," at a time when Frederick Davison (late of GRAY AND DAVISON), William HILL, and Henry WILLIS were absorbing and reinterpreting French and German influences. Walker's especially strong Open Diapason ranks proved powerful beyond the instruments' otherwise unpretentious proportions; but the sound was ultimately Anglican in taste, not truly suitable for non-English repertoire. Organs built under his watch include: Gloucester, St. Mary-de-Crypt (1830; two manuals; dism. 1866); Edgton, St. Michael the Archangel (1839; 1/4/pull-down); Killmore, Mayo (1842; to Lisnadill, Armagh, St. John's, 1930s); Bristol, Christ Church Clifton (1846; enl. Walker, 1885; reconstr. Rushworth and Dreaper, 1956; 3/37; reb. Wells, 2000–01; 3/54, electro-pneum.); Exeter, St. Olave's (1847; 1/5; rest. Drake, 1985); Romsey Abbey (1858; 3/33; pneum.; rest. Walker, 1995; Ped electro-pneum.); Peckham, London (1860; to Oxford, Woodstock Road Baptist, 1909; rest. Pipe Organ Preservation [Ireland], to Finglas, Dublin, St. Canice's, 2001; now 2/12); Ranmore, St. Barnabas (1866; 2/16; reb. Cartwright, 1954; 2/18); and Twyford, St. Mary the Virgin, Church Lane (1867; 1/8; enl. Burton, 1897; reb. Boston, 1956). Under James John Walker, the firm built instruments for: Esher, Surrey, Christ Church, Church Street (1886; reb. 1930; rest. 1983; now 3/40); Royal Holloway, University of London, Chapel (1886; reb. Harrison and Harrison, 1978; now 3/42); Glasgow, International Exhibition (1888; 4/44); Bagshot, Surrey, St. Anne's (1899; reb. K. James, 1983; now 3/26, mech./electric); London, Westminster, St. Margaret (1897; 3/58); Glasgow, Elder Park Church (1899; 2/14); Hemel Hempstead, St. Mary's (1910; 2/22, pneum.); and Lancing (Brighton) College (1914; reb. Walker, 1986, now 4/55, mech./electric). In the early twentieth century, instruments went to more exotic locations: Huelva, Spain, Minas de Riotinto, Capilla Bellavista (1914; two manuals), and Singapore, Orchard Road Presbyterian (1920; 2/12).

By the 1850s, Walker had already found a market in colonial Australia, a natural recipient for the Anglican-style organs the firm produced. The ORGAN HISTORICAL TRUST OF AUSTRALIA counts over fifty Walker instruments erected during the nineteenth century, especially in New South Wales (NSW) and Tasmania (TAS), which lacked significant local builders. Among the instruments Walker placed there were: Port Macqurie, NSW, St. Thomas's (1855; 1/5/pull-down); Deloiraine, TAS, St. Mark's (1860; 1/7); Campbell Town, TAS, St. Luke's (1862; 1/7); Parramatta, NSW, St. John's Cathedral (1863; 2/10); Cooks Hill, NSW, St. John's (1866; 2/12); Campbell Town, TAS, "The Grange" (1867; 2/14; to Launceston, TAS, St. Andrew's Presbyterian, 1922; enl. Fincham, 1935; now 2/24); Mulgoa, NSW, St. Thomas's (1868; 1/4); Hobart, TAS, Town Hall (1870; 3/30; enl. Fincham, 1929; enl. Walker, 1966–67; now 3/61); Sydney, NSW, St. Philip's, Church Hill (1873; 2/27; rest. Pitchford and Garside, 1987); Newtown, NSW, St. Stephen's (1874; 2/18): Seven Hills South, Sydney, NSW, St. Peter's (1882; 1/3/pull-down); and Rosalie, Queensland, Sacred Heart (1885; 2/7; rest. Jarrott, 1982).

After the death of John James, the Walker firm continued to produce instruments, but it had to compete with major firms like Harrison and Harrison as well as the UNIT ORGAN of John H. COMPTON and others and, eventually, the electronic organ. After World War II, the company aesthetic, which had never delved too deeply into late Romantic style, reestablished mechanical action as its primary mode, although combination and stop actions tended to be electric. Andrew Pennells was especially crucial to the firm's rebirth in the 1980s and '90s. Among the instruments of this period were: Singapore, Orchard Road Presbyterian Church (1962; 3/42); Liverpool, Metropolitan Cathedral (1967; 4/88); Glasgow/Renfrewshire, Paisley Abbey (re; 1872 Cavaillé-Coll/1902 Norman and Beard (1968; 4/66); Blackburn, Cathedral (1969; enl. Wood, 2001-02; four manuals); Worcester, Massachusetts, Our Lady of the Angels (1984; 3/40; mech./electric); Bolton, Town Hall (1985; 4/43; mech./electric); Sudbury, Massachusetts, St. John Evangelical Lutheran (1988; 2/21); Glasgow, Royal Scottish Academy of Music and Drama (1988; 2/22; mech./electric); Bromley, Kent, SS Peter and Paul (1991; 3/40; mech./electric); Northridge, California State University (1992; earthquake damage, 1994; rest. 1995; 2/20); Smithfield, Virginia, Historic St. Luke's Church (1992; 2/13): Birmingham, St. Chad's Cathedral (1993; 3/40; mech./electric); Volkersleier (Germany), Evangelisch-Lutherische Kirche (1993; 2/12; mech.); Norfolk, Virginia, First Presbyterian (1993; 4/53; mech./electr.); Bad Homburg-Gonzenheim (Germany), Heilig-Kreuz Kirche (st. 1867 Walker; 1993–94; orig. Bad Homburg, English Church); Darien, Connecticut, First Congregational/UCC (1996; 2/22; mech./electric); Hutchinson, Minnesota, Peace Lutheran (1997; 3/36, mech./electric stop); Holland, Michigan, Hope College (2000; 3/34); and Grand Rapids, Michigan, St. Mark's Episcopal (2004; 4/57).

Walker and Sons maintained its Australian presence, opening at least one branch (Sydney) and participating in the somewhat belated interest in historical preservation in that country. Besides restoring numerous smaller English and Australian organs, the firm worked on instruments for: Hobart, TAS, St. David's Cathedral (enl. 1858 Bishop/1917 Fincham; 1958; 3/55, electro-pneum.); Perth, St. George's Cathedral (enl. 1875 Hill/1903 Dodd; 1958–59; 3/57; dism. 1994); Perth, Western Australia University, Winthrop Hall (1959–60; 4/47); and Adelaide, South Australia, Town Hall (1990; 4/61; electric).

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WALZER

SEE MECHANICAL AIDS

WARREN

Family of Canadian builders of American origin. The leading builder of the family was Samuel Russell Warren (b. Tiverton, Rhode Island, 1809; d. Montreal, 1882), who with his brother Thomas D. Warren (d. 1862) were apprenticed to Thomas APPLETON in Boston. Thomas D. Warren remained in Boston, where he partnered with Appleton (1847–50). Samuel Russell Warren moved to Montreal in 1837, where he established a firm. Of Samuel Russell's sons, Charles S. Warren (1842–1933) became a partner in 1879 (renamed S. R. Warren and Son), while Samuel Prowse Warren (1841–1915) became a celebrated organist who inspired the founding of the AMERICAN GUILD OF ORGANISTS.

Samuel Warren worked in an era when some Protestant congregations still considered instrumental music to be an abomination, as they had in the United States in the eighteenth century. But he persevered and built several organs in Montreal and Toronto; his son Charles moved the firm to Toronto (1878) and brought pipe organs to Winnipeg, Manitoba, and other "Western" cities. The firm was purchased in 1896 by a Woodstock, Ontario, reed organ maker, Dennis W. Karn (1843–1916), who continued business in Toronto as Karn and Warren and gradually replaced organs with player pianos as a commodity. The company continued under various owners and names until 1957.

Samuel Warren's first new instrument was installed at Montreal, St. George's (Anglican, ca. 1843; 3/48), hydraulically blown, as was often the case in nineteenth-century cities; by 1897 it had been replaced by a CASAVANT FRÈRES organ, a fate many Warren instruments would meet. His most significant work was an organ (the third ever) for Montreal, Notre-Dame Basilica (Roman Catholic), which had been established in 1683. The original plan was for a four-manual, eighty-nine-stop tracker instrument, begun 1858; but financial problems led to a half-finished organ by 1861. Warren also had to reply to attacks in the Canadian press that he had ignored an agreement not to use any U.S. materials, even producing affidavits from his employees testifying that he had, indeed, been wholly Canadian in his production. Never finished, this instrument was replaced by another Casavant (1887–91), that company's first four-manual organ. Warren instruments that have survived, albeit much renovated or rebuilt, include Montreal, St. Patrick's Basilica (Roman Catholic) (1852; 3/31); Montreal, St. James the Apostle (Anglican) (1864), which experimented (unsuccessfully) separating pipes between the two sides of the chancel (Karn-Warren constructed a new instrument based on Warren's plan in 1900); and Montreal, St. James United Church (Methodist), built by "Warren Brothers of Ontario" in 1889. Later extant organs were no longer connected with the Warren family.

RICHARD KASSEL

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WATER MOTOR

A feeder BELLOWS operated by a hydraulic engine, fed by water from the subterranean city mains that were part and parcel of the industrial age in the nineteenth century. Water motors replaced hand-operated bellows in many instruments, or were introduced into new organs (e.g., the Hilborne L. ROOSEVELT organ in the Congregational Church, Great Barrington, Massachusetts).

In the Joy engine (invented by a railway engineer), feeder arms (a water wheel–like device) supplied a cylinder with water in alternating pressures, creating an up-and-down motion in a piston that was attached (via a vertical drive shaft) to the BELLOWS handle; the bellows could also be hand-operated when water pressure was insufficient or unavailable. When the organ's RESERVOIR was full of air, a pneumatic valve closed off the water supply.

Another Victorian technology, the hydraulic ram (a pneumatic-like device based on compressed water generated by horizontal water pressure), made the water motor feasible in rural areas. Powered by a stream, the ram lifted large amounts of water into a cistern located sufficiently above land level so that the water could in turn be directed with the help of gravity for use in a house, where water supplied both domestic needs and the Joy engine ultimately attached to the HOUSE ORGAN. The power of this system is demonstrable by the original and the new 1893 organs in New York's Fifth Avenue Presbyterian Church. These were powered by a steam-driven hydraulic motor piping water to a tank above the church's clock tower; the water then flowed by gravity to a basement cistern and operated the feeders of the bellows. (Eventually an electric BLOWER was installed.) Both devices were automatic, reliable, largely trouble-free and, in the days when water power could be taken for granted, inexpensive to run. They also removed the arduous burden of bellows operation in larger organs from human hands and feet.

The major risk of the system was the large amount of water piped close to the organ. A burst pipe or undetected small leak could ruin all wood and leather components, necessitating a very expensive reconstruction. Larger instruments needed several engines, and water pressure might not suffice; in some locations, water companies reduced or shut off the supplies for maintenance on Sundays, when the organ played its greatest role. (After one recital, a wag compared the water pressure in the organ's engine to the "sprinkling [of] flower beds" and called for a return to the "reliable . . . old-fashioned pumping machine, i.e., a man.")

Despite some inroads by steam-motivated blowers (most of which ended up in mechanical instruments), water motors were not superseded until the early twentieth century, when electric blowers replaced original water motors and became the motor of choice in new instruments. While many of the original water motors have been recovered in storage and made into museum pieces, there are smaller working organs with water motors, especially of English origin, in places where water rates are not prohibitive.

See also **Hydraulis; Mechanical Organ**

RICHARD KASSEL

WEDGE BELLOWS

An indirect type of feeder BELLOWS (*Spanbalg*, board bellows) made of wooden boards and ribs, flexible leather strips, and metal bindings. It was powerful enough to be separated from the organ CONSOLE, and was raised by a hand lever to fill up with air. The "wedge" shape refers to its sidelong appearance, in which one end rises as it fills up, then sinks as it empties (hence its alternate name, "diagonal bellows"); from above, wedge bellows are rectangular in shape. Excepting smaller organs, at least two bellows were needed per instrument to keep the wind flowing as continuously and steadily as possible; the larger the instrument, the more bellows were needed. The wedge bellows succeeded the cuneiform (forge) bellows, a smaller device with a wedge-shaped frame (i.e., when viewed from above), and with which it is sometimes confused.

At first, wedge bellows expelled its air when an operator, holding on to a bar for support, pushed down on or (with larger bellows) stood on the bellows and forced the air into the WINDTRUNK. By the sixteenth century, human power were being replaced by stone or metal weights or ballast; these, in combination with gravity, accomplished the same goal. The single-wedge bellows (referring to the fold between the bottom and top boards) was improved by the addition of a hinged fold or folds to the LEATHER collector, secured by wooden ribs; the multifold wedge stabilized the flow of air as it entered the windtrunk.

There were at least two other indirect systems that, like the wedge bellows, pumped air into the windtrunk without the use of an additional storage space. Both used a pulley rope instead of a lever to fill the bellows with air; once filled, weighted gravity expelled the air much as the wedge bellows. The lantern bellows (seventeenth century) was named for its square shape. The box-bellows (seventeenth to nineteenth centuries) raised a box that fell within a second, slightly larger box; the two boxes produced an air chamber sufficiently airtight to expel air properly, avoiding the need for leather folds or hinges.

The shape of the box-bellows may have suggested the invention of a two-part bellows that improved wind stability even further. In the early eighteenth century, after experiments with using two diagonal bellows in step to accomplish stability, the wooden and metal PARALLEL RESERVOIR and feeder bellows (or feeder bellows and magazine) was invented. The lever-operated bellows served as both base and wind feeder to a reservoir that stored the wind and descended as air was expelled. An exhaust valve permitted the dispersal of excess air when necessary. (Later versions reduced the feeder to a lever-operated fold under the RESERVOIR, now scaffolded to permit the feeder to expand. This arrangement was sometimes referred to as a "horizontal bellows.")

Essentially, the parallel reservoir and feeder bellows of the turn of the nineteenth century was the fulfillment of the purely mechanical bellows system. The feeder bellows, with its foot-operated pedals or treadles, continued to serve house organs and became the mechanism of choice for the new REED ORGAN, or harmonium.

RICHARD KASSEL

WEGSCHEIDER, KRISTIAN (B. 1954)

German organbuilder. Born in Ahrenshoop, Wegscheider apprenticed with Jehmlich Orgelbau Dresden (1975–78). His keen interest in historic organs was encouraged by the firm, which sent him to Berlin and Leipzig to further his study of musical instrument restoration (1976–80). As director of Jehmlich's restoration division, Wegscheider planned and directed, among other projects, the restoration of the 1714 Gottfried SILBERMANN organ in Freiberg Cathedral (1981–83). Following two years of planning, Wegscheider established his own organ-building and restoration workshop in Dresden in 1989; five years later, having outgrown its original quarters, Wegscheider moved to Dresden-Hellerau, into what were originally farm buildings but more recently had been used for a woodworking shop.

Orgelwerkstatt Wegscheider divides its activities between restoration of historic instruments and building of new, often experimental, organs in classical style. His first instrument, for example (Allstedt, Schloßkapelle, 1990), was built using only traditional methods and materials such as wood, tin, lead, leather, and brass wire (but without plywood, chipboard, nitrocellulose paint, aluminum, etc.). Inspired by the Charles B. FISK dual-temperament organ at Stanford University (Palo Alto, California), Wegscheider provided six extra notes per octave so that the organ could be played in a meantone or well-tempered tuning system. Wegscheider's horizontal design (1992) for a continuo organ has been in constant production. The organ for Dresden-Loschwitz (1997) has twenty registers; nine of them are duplexed and playable on the second manual by means of a *Wechselschleifen* (reverse slider).

Wegscheider has restored more than thirty-five instruments, including a number of one-manual organs (e.g., Bremen Cathedral, 1734 G. Silbermann eight-stop organ), as well as Langhennersdorf (1722 Z. Hildebrandt two-manual organ; 1996); Reinhardtsgrimma (1731 Silbermann two-manual organ; 1997); Hohenmölsen (1851 Ladegast two-manual organ; 1998); and Schwerin (1869 Friedrich Friese two-manual organ). Wegscheider collaborated on two major European restoration projects: the 1755 Gottfried Silbermann organ in the Dresden Hofkirche (Jehmlich, 2001–02) and the 1855–66 Friedrich LADEGAST organ in Merseburg Cathedral (Eule and Scheffler, 2003). Wegscheider was design consultant for the Hildebrandt-style organ built by Fritz Noack in 1995 for Houston, Christ the King Lutheran Church (1995).

LYNN EDWARDS BUTLER

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WELL TEMPERAMENT

This seemingly ungrammatical expression is an attempt to translate the term for a late Baroque German style of tuning that contemporary theorists described as *wohl temperiert* or, more often, as *gute Temperatur* (good temperament). One English manuscript of about 1690 also refers to "well tempering," but without making the meaning very clear. The term covers various adjustments to different MEANTONE TEMPERAMENTS developed to meet composers' increasing desire for viable major and minor chords and scales based on all twelve notes of the chromatic octave; a more recent term is "irregular temperments." This development was etched forever in musical history by the two great cycles of keyboard music by Johann Sebastian Bach, *Das wohltemperierte Klavier* 1 and 2 (1722, 1742). Thus, although "good," "full," or "complete" temperament would be a more grammatical expression, "well temperament" retains a etymological relationship to the Bach title that keeps the latter term alive.

See also **Tuning and Temperament**

MARK LINDLEY

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WELTE ORGAN COMPANY

An American outgrowth of the Freiburg im Breisgau–based German firm of M. Welte and Sons. Michael Welte began developing clock mechanisms in 1832; by 1849, he had created what became known as the ORCHESTRION. This self-contained parlor organ was exclusively self-operating by means of large pinned cylinders; in 1885, the firm developed paper rolls as an improved means of running the instrument, adopting this new system exclusively in 1887. In 1904, Welte introduced the first reproducing piano, the Welte-Mignon. Finally, in 1910, after developing a pipe organ recorder, Welte perfected a reproducing organ mechanism called the Philharmonic (a name Welte also applied to smaller pipe organs).

Welte was quick to broaden its customer base. Michael Welte's son, Emil Welte, opened a New York showroom in 1865, through which numerous orchestrions (and eventually all Welte instruments) were introduced to the American public. The market grew so rapidly that Welte established a factory in Poughkeepsie, New York. Historians are unclear as to exactly what was produced in this plant. While some organs may have been completely fabricated there (Junchen notes that the plant bought pipes from Gottfried in Erie, Pennsylvania, during the early 1900s), other instruments were purchased

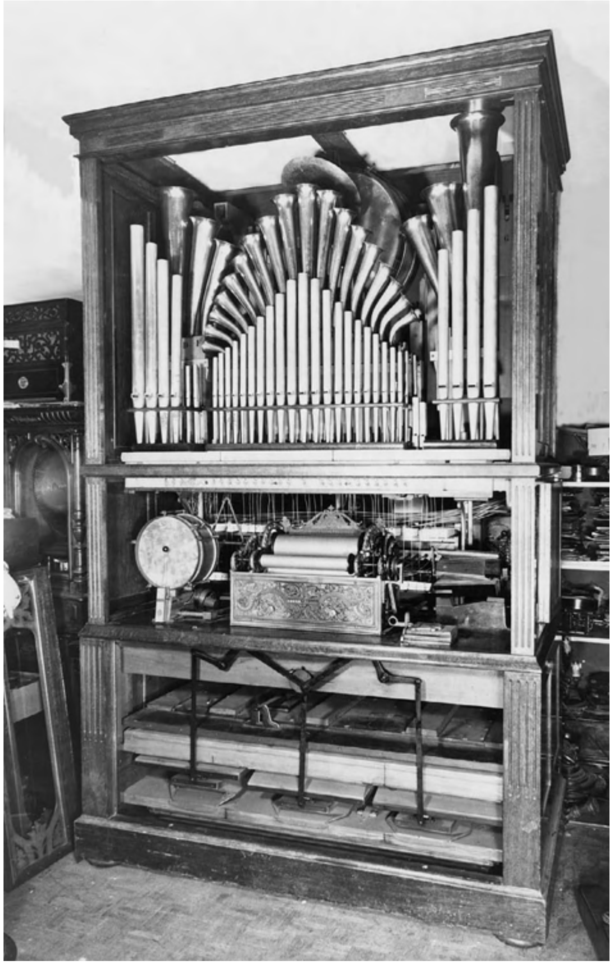

Fig. 80. Welte roll-playing orchestrion organ (Photo courtesy Arthur W. J. G. Ord-Hume, The Library of Mechanical Music & Horology.

complete from HOOK AND HASTINGS, M. P. MOLLER, and Ernest M. SKINNER. However, every Welte pipe organ was provided with a Welte console, player, and nameplate.

Some of Welte's arranged rolls are especially significant, as they were transcribed from orchestrion rolls, which may have been transcribed from pinned cylinders. The registration and expression would certainly have been reedited to suit the Philharmonic, but the rhythm and overall style tend to suggest salon music practices of the 1870s and '80s. Along similar lines, some Welte rolls were also derived from the playing of pianists who had recorded for the Welte-Mignon Reproducing Piano.

For organists, the Welte has had considerable significance due to its roster of performing artists (Joseph Bonnet, Marcel Dupré, Reginald Goss-Custard, Alfred Hollins, Edwin H. Lemare, Max Reger, and Karl Straube), many of whom play their own compositions. While Welte players have controls for tempo modulation, there is actually only one roll speed, the one employed throughout the recording process. A well-restored machine running at the proper speed reproduces the original tempo, not only crucial for phrasing, but essential for Welte's system of timed expression. Thus, the Welte offers many important documents of human performance.

World War I halted Welte's American activities when the U.S. government seized all assets and the majority of stock. These were offered at auction in 1919, and purchased by George W. Gittins for $100,000. Gittins eventually sold the Poughkeepsie facility and built a new organ factory in the Bronx, adjacent to a piano firm he already owned. From then on, Gittins's company was related in name only to the original German Welte firm. Welte continued to build residence instruments, but Gittins decided to build church and concert organs. In 1925, he hired well-known organ designer Robert Pier Elliot (1871–1941) to mastermind the new type of instrument. Elliot's far-reaching experience with the AUSTIN ORGAN COMPANY, Robert HOPE-JONES, Kinetic (manufacturers of BLOWERS), and especially W. W. KIMBALL meant a virtually brand-new Welte organ.

Mechanically, the new instrument borrowed heavily on designs that Elliot had helped to establish at Kimball. Tonally, Elliot desired not only to build first-class symphonic church organs, but fully unified, up-to-date theater instruments. Elliot's high standards lifted the quality of construction to match the industry's finest. For example, a company accustomed to building only simple, if often elegant, residence consoles was suddenly offering drawknob, tablet, and horseshoe designs, all superbly crafted. Elliot brought with him many experienced personnel from Kimball and other firms to help implement this significant changeover.

In October, 1927, Elliot left Welte to work for the ÆOLIAN COMPANY. About the same time, Charles Courboin became involved with Welte. Courboin was a respected organist who played regularly on the giant organ at the Wanamaker Store in Philadelphia. Initially, he made rolls, but later he acted as general manager and vice president. That same year, Richard O. Whitelegg (1890–1944) joined the company as head voicer. An Englishman, Whitelegg had trained with Henry WILLIS in London as a voicer, and he helped Welte pursue an ambitious and successful period of tonal design. Whitelegg's voicing fused an early twentieth-century English conception of brilliance into the then-prevalent American symphonic style, producing some exemplary installations (Minneapolis, St. Mark's, 1929; Boston, Church of the Covenant, 1929). In 1931, Whitelegg left to work for Moller, for whom he accomplished a similar tonal transformation.

Unfortunately, 1927 was also a year of turbulent business troubles. The previous year, the organ division of Welte became its own corporation, known as the Welte Organ Company. In 1927, a vast quantity of the new company's stock hit the market all at once, causing prices to fall drastically. This left the company without sufficient working capital and thus no means of securing credit. Despite considerable sales, the firm was in receivership by April 1929. All assets (save real estate) were acquired by Donald F. Tripp for $79,000, and the corporation was renamed Welte-Tripp, reflected by new nameplates on recent Welte instruments. Meanwhile, Courboin convinced Tripp to sell the Bronx factory and move to the former Schick razor factory near Greenwich, Connectict, where the company continued to build organs for the next two years.

One of the final Welte-Tripp installations was Colorado Springs, Colorado College, Shove Chapel (1931; 3/65; extant). That July, Tripp sold Welte to Kimball. (Kimball representatives promptly replaced original Welte-Tripp nameplates with those of Kimball.) Kimball continued to offer the Welte player under the name Kimball-Welte, but absorbed none of Welte's other mechanical designs—hardly necessary, since the Welte organ developed by Elliot used substantially the same design that Elliot had created for Kimball earlier.

Welte's finest years (1926–31) reflected a remarkable if brief period in American organ building, a time when a significant proportion of builders were producing instruments of superior mechanical quality and tonal vigor. To this distinction, Welte could add the notable success of its player mechanism. The firm folded one year short of the hundredth anniversary of Michael Welte's first musical invention.

See also **Player Pipe Organ**

JONATHAN AMBROSINO

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WENDER, JOHANN FRIEDRICH (1655–1729)

German organbuilder. Research into the Mühlhausen resident's life and career is incomplete. His most significant organ may have been built for Arnstadt, Neue Kirche (1701–3, 2/23; reconstr. Hoffmann, 2000; seven orig. ranks), which Johann Sebastian Bach examined in 1703 and at which he served as organist (1703–7). Wender's influence may have helped Bach gain the organist position at Mühlhausen, St. Blasius (1707–8), whose organ Wender had built (1689–91). During his short tenure Bach submitted a memorandum to the parish council, requesting changes and additions to the instrument. Wender rebuilt the organ 1708–09 (3/37) in accord with Bach's design. Wender may therefore be considered the organbuilder with whom Bach was most closely involved during the early years of his career.

RICHARD KASSEL

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WERCKMEISTER, ANDREAS (1645–1706)

German music theorist and organ expert. While Werckmeister's numerous treatises cover a broad range of theoretical and practical topics, he is perhaps best known for his writings on temperament and on the design, construction, and testing of organs; these discussions were highly influential in their own time and have been important in the historical organ revival of the twentieth century.

Werckmeister's *Orgel-Probe* first appeared in 1681 and was republished in a considerable enlarged edition (*Erweiterte und verbesserte Orgel-Probe*, in 1698). The treatise presents extensive citeria for the evaluation of chests, reed and flue pipes, bellows, windtrunks, and other components. Werckmeister discusses project planning and contracts, considers possible dispositions, describes a number of special tests, and makes note of tricks commonly employed to conceal defects (an aspect of the treatise that aroused considerable ire among builders). Though it is sometimes regarded as an original and prototypical work, the *Orgel-Probe* was by no means the first such manual, and Werckmeister in fact appears to have based his treatise on a manuscript copy of an earlier, unpublished handbook for organ inspection jointly authored by Michael PRAETORIUS and Esajas COMPENIUS. Though Werckmeister covers far more material and goes into much greater detail, numerous parallel passages establish that he used the Praetorius/Compenius "Kurtzer Bericht" as a fundamental starting point (see Panetta, "Praetorius, Compenius, and Werckmeister").

Werckmeister's *Orgel-Probe* publications served in turn as an important background for much later writing and thinking on the subject of proper organ design. The 1698 revision was reprinted five times (including a translation into Dutch), and major portions of the treatise were incorporated into several eighteenth-century works published under others' names. Williams has also demonstrated that Johann Sebastian Bach, in preparing certain of his own organ inspection reports, relied heavily on the criteria and even the specific language of Werckmeister's 1698 revision; others, both examiners and builders, did so as well. Werckmeister's *Organum Gruningense redivivum* is perhaps the most detailed surviving account of the inspection and adjustment of a new organ. Along with many valuable technical details, the work also transmits the names of the fifty-three organists invited by Duke Heinrich Julius of Braunschweig to examine the Gröningen instrument; the group included Michael Hieronymus Praetorius; Hans Leo, Jakob, and Kaspar Hassler; and Heinrich Compenius. Both the organ and the colossal wine-cask commissioned by the duke for the nearby Residenz-Haus are further described in the 1700 *Gründliche Beschreibung*.

Werckmeister is also of considerable importance as an early proponent of circulating irregular temperaments whose goal was to render most or all tonalities usable. Werckmeister first set forth two irregular temperaments in the second chapter of the 1681 *Orgel-Probe*. The material of this chapter became the core of the 1691 *Musicalische Temperatur*; further observations on temperament appear in the 1698 *Orgel-Probe*

and in several of Werckmeister's other treatises, including the *Nothwendigsten Anmerckungen*.
See also **Tuning and Temperament**

VINCENT J. PANETTA

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WERKPRINZIP

A twentieth-century term, associated with the ORGAN REFORM MOVEMENT, describing a principle (*Prinzip*) by which each department or division (*Werk*) is placed in a distinct chest (or chests) and controlled by a single manual (or pedalboard). The Werkprinzip approach developed as the BLOCKWERK was broken down into separate departments during the sixteenth century and reached its apex in the Baroque. The separation of divisions was naturally reflected in the architecture of the case, with its alternation of central CHEST, FLAT, and PEDAL TOWER; for example, the HAUPTWERK (GREAT, GRANDE ORGUE) would hold the most prominent place in the main (central) chest, while the PEDAL (organ) would be divided between left- and right-wing towers. Originally the RÜCKPOSITIV (*Positif de dos*) had an independent keyboard and pipechest located behind the player; but many of its functions (chorus, echo, solo, or swell organ) were taken over by the BRUSTWERK (between the console and the Hauptwerk), the OBERWERK (above the Hauptwerk), or UNTERWERK (behind and below the main chest). (There is some flexibility of terminology throughout this period.) The resulting acoustic separation of tone qualities served the music of the Baroque especially well, even as it encouraged the evolution of coupling devices. Other elements such as register, scaling, case resonance, and specifications contributed to the overall effectiveness of this approach. Technical limitations (such as wind and tuning) discouraged the combining of similar stops in different departments. During its heyday, however, the Werkprinzip was more intuitive than theoretical, and applied mostly to northern Europe; it was not necessarily the basis of French, Iberian, and English instruments, which placed departments in less stereotyped ways. More importantly, the signification of the Werkprinzip was important to postromantic, neoclassical, and neobaroque builders, although not all treated the idea as sacrosanct.

RICHARD KASSEL

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WESTFIELD CENTER

An organization, founded in 1979 as the Westfield (Massachusetts) Center for Early Keyboard Studies, that promotes promotes classical keyboard music and instruments. The Westfield Center is recognized nationally for its advocacy on behalf of the organ, fortepiano, harpsichord, and clavichord, and for outstanding workshops and symposia, publications, and international tours.

Westfield Center workshops and symposia are known for the synergy they produce among performers, teachers, instrument builders, and music scholars. They often highlight newly built organs—for example, the Charles B. FISK "CAVAILLÉ-COLL organ" at Oberlin (Ohio) Conservatory; the Paul FRITTS organ at Pacific Lutheran University, Tacoma, Washington; the Greg Harrold Spanish organ in Berkeley, California; the meantone Fisk organ at Wellesley (Massachusetts) College—and have also focused on specific composers and repertoires. The Westfield Center has also developed nationally touring programs for general audiences: *Mozart's Nature, Mozart's World* educated the public about Wolfgang Amadeus Mozart and his place in eighteenth-century culture; *Festival Organ: King of Instruments* focused on the organ—its construction, sound, history, and repertoire—to encourage a deeper understanding of Western musical heritage. This highly acclaimed festival organ exhibition traveled to thirteen sites in the United States and Canada (1995–99).

Westfield Center publications include *Timeline of the Organ: 2600 Years of History*, as well as a two-volume monograph on American organbuilder Fisk; *The Historical Organ in America*, which documents twelve organs built or restored by American and Canadian builders; and *Hamburg's Role in Northern European Organ Building*, a translation of Gustav Fock's monograph on Renaissance and early Baroque North German organ building.

In 1999, Roger Sherman became executive direct of the center, which relocated to Seattle.

See also **Organizations**

LYNN EDWARDS BUTLER

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Westfield Center. <http://www.westfield.org>.

WHEATSTONE, CHARLES (1802–1875)

English scientist, philosopher, and inventor. He was the most prominent member of a family of music publishers and instrument makers. The original Wheatstone Company was presumably established in London (ca. 1750), operating at various locations and publishing sheet music and collections of glees. An older family member, also named Charles Wheatstone, became associated with the company about 1791; from 1815 it was known as C. Wheatstone and Company. William Wheatstone, probably the brother of Charles, was a flutemaker and teacher who published numerous collections of flute music. In about 1826 he joined with Charles; by the middle of the century, the firm was called William Wheatstone and Company.

Charles Wheatstone, probably a cousin or nephew of William, was the son of a Gloucester music seller. On his arrival in London he took up instrument making, but soon turned his attention to scientific subjects, doing significant work in the fields of light, optics, telegraphy, recording systems, and electricity. A method for measuring electrical resistance, the Wheatstone bridge, was named after him. He did much work in the field of acoustics and was the first to formulate a theory of vowel tones. His experiments with free reeds resulted in the invention in 1825 of a pressure-actuated mouth organ consisting of a shallow upended box with a single blow-hole, played by means of buttons on each side. This was patented in 1829 as the Symphonium. His bellows-blown concertina, patented in 1844, improved upon the diatonic accordion of Christian Friedrich Ludwig Buschmann (1805–1864) and Cyrillus Demian (1772–1847). Its chromatic range and expressive tone, with dynamics and articulation directly under the control of the player, attracted the attention of composers and performers. A later improvement was the octagonally shaped Aeola of about 1845.

Wheatstone is credited with building a harmonium as early as 1834 and a portable harmonium in 1851. Wheatstone was the recipient of many honors, receiving a doctorate from Oxford in 1862 and from Cambridge in 1864. A Fellow of the Royal Society from 1836, he was a professor of natural philosophy at King's College, London, and was knighted in 1868. He died in Paris on 19 October 1875. The Wheatstone firm published much music and carried on a considerable trade in musical instruments, particularly concertinas. In 1961 the name was purchased by Boosey and Hawkes.

JAMES HOWARD RICHARDS

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WHITEHOUSE

Australian organ-building firm. The firm was founded in Brisbane, Queensland, by Benjamin Burton Whitehouse (1860–1954) and Joseph Howell Whitehouse (1874–1954). Although Benjamin commenced work on organs soon after he emigrated to Queensland in 1883, it was not until his brother Joseph (who had worked with Norman and Beard and Henry Willis and Sons) arrived in 1897 that a partnership was formed and the production of new organs increased. From 1903 the firm was known as B. B. Whitehouse and Company, but in 1921 it commenced trading as Whitehouse Brothers at new premises in the Brisbane suburb of Red Hill. Following the death of Joseph Whitehouse, the firm was managed by his son, Joseph Whitehouse, Jr., and after 1971 by his grandson, Kevin M. Whitehouse. The firm continued to operate until its closure in 1982.

From the outset, Whitehouse Brothers gained a reputation for the construction of instruments using excellent materials and workmanship designed to withstand the high temperature and humidity of tropical Queensland. Although mechanical action was favoured through to 1910, an excellent tubular-pneumatic system was developed by the firm, commonly using sliderless ventil chests and components imported from August Laukhuff of Germany. As a result of their success, Whitehouse Bros. secured contracts to build almost one hundred new organs in all Australian states, most notably in Queensland and New South Wales. Although electro-pneumatic instruments were built by the firm in the 1930s, tubular-pneumatic actions continued to be constructed as late as 1957. The tonal disposition of Whitehouse instruments reflected the ideals of British Romantic organbuilding until the influence of the Organ Reform Movement became evident in the 1960s.

Kelvin Hastie

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WICKS

American organ-building firm. Incorporated in 1906 as the Wicks Pipe Organ Company in Highland, Illinois, the firm has built over 6,200 pipe organs and is known for its development of a patented electric action (the Direct-Electric system), which makes the building of unified instruments easier. Its philosophy of tonal design is not restricted to any particular style or era, however.

John Frank Wick (1881–1948) built his first organ in 1899, using mechanical action, on the second floor of the Highland store where he worked as a watchmaker; that instrument is kept in the museum at Carbondale, Southern Illinois University. Seven years later, John Frank and his brothers, Adolph Aloys Wick (1873–1943) and Louis J. Wick (1869–1936), established the Wicks firm. John Henry Wick (1912–1940) and Martin M. Wick (b. 1919), sons of John Frank, later joined the firm, Martin becoming its president in 1948. John Sperling became tonal director in 1957. During its first thirteen years, Wicks built 275 organs, but production soared to one thousand instruments in the fifteen years following the development of the all-electric action. Production in the late 1980s averaged seventy to eighty organs per year, with installations throughout the United States and abroad.

Wicks began the use of electro-pneumatic action around 1910, but an all-electric one had been developed by 1914. The action, which uses a single electromagnetic valve that combines straight and circular motion under each pipe, was further refined and repatented in 1922 and 1929. Other than the key itself, the pipe valve is the only moving part of the action, as there is no air in the Direct-Electric system. Although the company began building a few mechanical action organs in the 1960s, it has otherwise continued to use all-electric action. Inasmuch as this action permits economical unification, many Wicks installations have been small and medium-sized in terms of ranks but large in numbers of stops. A number of stock models have been produced; however, the firm has also built many larger instruments, including ones with little or no unification. Wicks builds all its own components and pipes.

The company's more important instruments include those at the Grand Rapids, Michigan, Basilica of St. Adalbert (1980; 3/72); Atlanta, Morehouse College (1982; 4/92); and Memphis, Tennessee, Second Presbyterian (1987; 4/87). The Wicks action has occasionally been added to organs by other builders, the most prominent being the Skinner organ in the National Cathedral in Washington, D.C. (late 1980s).

Arthur Lawrence

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WIENERFLÖTE

The "Viennese Flute," also called the Deutsche Flöte, considered part of the Melodia family by Maclean. This stop occurs on one of the upper manuals as an 8' or 4' solo stop, especially in Swiss organs, where it might be called the Concert Flute. It may also be called Zartflöte and Sanftflöte; labeled thus, it occurs in the 4' and 8' registers in the Nicolaikirche, Leipzig. The pipes of the Wienerflöte are open and quadrangular, and have inverted circular or semicircular mouths, partly over or against which are adjusted sloping caps. Such a formation would point to the production of an imitative quality of flute tone, but not so pronounced as that of the harmonic Flauto Traverso, nor so valuable in solo effects or registration.

See also **Stop**

EDWARD L. STAUFF

WILCOX AND WHITE

American organ-building firm. The Wilcox and White Organ Company was formed in 1876 or 1877 in Meriden, Connecticut, a partnership of silver industrialist Horace C. Wilcox (d. 1890) and Henry Kirk White (b. 1822), an experienced builder of REED ORGANS. White had begun building melodeons in New London, Connecticut, in 1845, then moved in 1853 to the reed organ center of Washington, New Jersey, and subsequently took employment in 1865 with the ESTEY Organ Company. The Wilcox and White firm began by making various small roll-operated MECHANICAL ORGANS, including organettes for the Mechanical Orguinette Company (founded 1878), which was renamed the ÆOLIAN ORGAN COMPANY in 1887. Although known for its automata, the company soon gained a reputation for its parlor organs because of superior design and workmanship. Larger PLAYER PIPE ORGAN models with fourteen to twenty-eight stops were introduced, and the firm even ventured into the pipe organ field with an automatic instrument. After Wilcox's death, Henry Kirk White become the senior member of the firm and was joined by his three sons, all experienced technicians who had been in the employ of Estey. One of Henry Kirk's sons, Edward H. White, along with his nephew Frank C. White, were active in the development of the large Symphony player organ, which at one time rivaled Æolian's Orchestrelle in popularity. Introduced in 1888, this instrument used a pneumatic player system, later the basis for the company's player and reproducing pianos.

In 1894 the company introduced an early example of the true piano-cased reed organ, doing away with DRAWSTOPS, treadles, and SWELL levers. Winding was accomplished by pumping the piano pedals; REGISTRATION was controlled by button-operated pneumatic motors. The compass was 7-1/3 octaves (eighty-eight keys), the same as the contemporary piano. Despite the firm's earlier conviction that its future lay with the reed organ, it underwent a reorganization in 1897; the word *Organ* was dropped from its name, and the plant expanded and capital increased for the manufacture of the Angelus push-up piano player. Another brainchild of Edward H. White, the Angelus was provided with two sets of reeds, which could be played by means of the roll, independently of or in conjunction with the piano. A built-in version of the mechanism was installed in Knabe, Lindemann, Norris, and, later, Wilcox and White pianos. By 1906 the company was exporting about one-fourth of its output. In 1917 a reproducing version of the player piano mechanism called the Artrio-Angelus was introduced. However, the company had clung to outmoded design concepts; in 1921, it went bankrupt. The Angelus name was sold to Simplex, though its recording studios remained open until 1925.

JAMES HOWARD RICHARDS

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WILHELM, KARL (B. 1936)

Canadian organbuilder of German ancestry. Born in Lichtental, Rumania, on 5 July 1936, Wilhelm was raised in Weikersheim, Germany, where he apprenticed with the August LAUKHUFF firm (1952–56). Following his apprenticeship, he worked with the Swiss builder METZLER in Dietikon. In 1960, he was hired by CASAVANT FRÈRES in St.-Hyacinthe, Quebec, to found and head the department for the production of mechanical action organs. While at Casavant, he trained several employees to assist him and coordinated the design and construction of twenty-six organs. In 1966, the year he became a naturalized Canadian citizen, Wilhelm started his own firm, Karl Wilhelm, Inc., in St.-Hyacinthe. The firm relocated to a more modern workshop in Mont St.-Hilaire, Quebec, in 1974.

Wilhelm specializes in tracker organs of all sizes, following the principles of the classical tradition. Although his instruments contain the basic stoplist to play classical German and French literature, his three-manual instruments may contain a large Swell division suitable for the accompaniment of Anglican church music or the performance of Romantic repertoire. Signature features of his organs include free-standing cases of solid white oak, hand-carved pipeshades, and cuneiform (forge) bellows. With the exception of German metal pipes and electric blowers, the majority of the pipes and accompanying components are constructed in the Wilhelm workshop, including handmade pipe metal pipes and flute pipes that are either hammered lead with soldered-on caps or cone-tuned for greater tuning stability. Wilhelm favors classical open-toe voicing for natural speech and mellow blend. His organs use well-proportioned wooden windtrunks and slider windchests in order to produce a buoyant sound quality.

A small firm, Wilhelm has built over 150 organs in Canada and the United States, all mechanical action; there are also two Wilhelm organs in South Korea. Its instruments range from single-stop, one-manual portative style organs to three-manual instruments, the largest of which is the fifty-stop organ at Toronto, St. Andrew's Presbyterian.

Ross Updegraff

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WILLIS, HENRY, "FATHER" (1821–1901)

English organbuilder. Born in London on 27 April 1821, he taught himself to play the organ. He and his brother George Willis were sons of an organbuilder, also named Henry Willis. During his apprenticeship with John Gray (later of Gray and Davison), Henry Willis claimed to have invented the backfall and sticker coupling mechanism he would later use in his instruments. He worked in Cheltenham for W. E. Evans, where he met the organist Samuel S. Wesley. Returning to London (1845), he obtained the contract to rebuild the Gloucester Cathedral organ, thanks to Wesley (1847), adding a twelve-stop, full-compass Swell. The turning point of his career was his acquaintance with the pneumatic lever, the result of visits to Aristide Cavaillé-Coll and Charles S. Barker in France (1848–49).

In 1851, Willis announced "the first successful large organ yet constructed in England" for the Great Exhibition at London's Crystal Palace. This organ (3/70) was furnished with thumb pistons, relief pallets, a thirty-two-note pedalboard, and an improved Barker lever that allowed for pneumatic combination action. While at the exhibition, he and Wesley examined the innovations of other builders. Noting the the concave pedalboard of the Schulze instrument, Wesley suggested that it should radiate as well, leading to the radiating and concave pedalboard (which became standard in the United States and Britain, but not elsewhere).

Willis, who had been submitting proposals for it beginning in 1841, finally completed an organ for Liverpool, Great George Street Chapel in 1855 (reconstr. 1867; 4/100). Wesley's original specification was not to Willis's liking; the instrument that resulted was a compromise, with old-fashioned (English) GG compass manuals (raised to C in 1898) but modern (German) C pedals. Some aspects of the instrument, such as the high-pressure reeds and a cast iron 32', were not unsuccessful; more helpful and one of the first English uses of angled stop jambs. The instrument received mixed reviews; Willis's rebuild in 1867 did not undo the damage done to his reputation, and it was some years before more large contracts came his way.

In the meantime, Willis built many small organs, including about two hundred "Scudamore" (one-manual) organs between 1858 and 1862. He also patented improvements in the design of pneumatic levers and was the first English builder to use tubular-pneumatic action (1857), which he later applied it to swell control (1861) and stop actions (1868). In an age that venerated progress, Willis's success owed much to his mechanical ingenuity. His long list of patents includes relief pallets (1851, 1861), crescendo pedals (1857), improvements in swell movements (1861, 1888, 1890), and hydraulic blowing engines (1857, 1893).

By 1871 Willis was firmly reestablished as a builder of first-class large organs, with instruments for two performance spaces, the Alexandra Palace (1875; 4/98), and the Royal Albert Hall (1871–72; 4/110; reb. Harrison and Harrison, 1933; now 4/146). Willis and Sons rebuilt the 1850 Bishop organ at London, St. Paul's Cathedral, several times between 1862 and 1960; its exemplary full Swell, high-pressure chorus reeds, characteristic solo voices, and divided cases (the connections made by tubular-pneumatic action running beneath the chancel) determined the design of cathedral organ design for through World War II. Its most recent restoration was by Mander (1992–94; now 5/108).

Tonally, Willis organs are unmistakable. Willis's flue work was clear and competent, if not quite as refined as some of his contemporaries. The oft-quoted criticism of the Albert Hall's flue work as being too stringy was probably due to the chorus of Gambas being farthest forward on the exposed Great soundboard, but Willis did use relatively narrow mouths and tuning slots, which result in a keen sound. With the help of his brother George, Willis developed increasingly smooth and powerful chorus reeds on increasing pressures, which sometimes overwhelmed the flue work. George also helped develop imitative reeds such as the Corno di Bassetto, bringing the closed shallot from his apprenticeship with J. C. Bishop. The reeds have screwed weights for controlling bass reed tongues (developed either by George Willis or Henry's son Vincent) and resonators of natural length; typically, the chorus reeds will be on 6" or 7" wind pressure. The fluework is often slotted, with dubbed lips and small toe holes. Tierce mixtures, Gedeckts, Harmonic Flutes, and orchestral reeds are found in all but the smallest instruments.

Vincent Willis (ca. 1841–1928) was responsible for many inventions included in the later Willis organs, including the touch-sensitive floating pneumatic lever (1884) and the advanced-charge pneumatic action (1889). He also developed illuminated drawstop heads and new reed voicing devices. Although Henry Willis had a keen interest in developments by others, which he freely improved upon, he became increasingly resistant to change, insisting that any innovation be demonstrated in a finished organ. To escape this obstacle, Vincent moved to Liverpool in 1873 to set up a branch, but returned in 1878 to become a partner at the same time as his brother Henry Willis II (b. ca. 1851).

After "Father" Willis's death on 11 February 1901, Henry II completed an organ for St. Patrick's Cathedral, London (1902). Vincent and Henry II did not agree as to whether the firm should continue (Henry II) or be liquidated to cover debt (Vincent). The dispute was settled in 1906, and Henry II kept the firm going (an example of their work is Port Sunlight, Christ Church United Reformed, 1904; 4/46). Henry's son Henry Willis III (1889–1966) took over the firm in 1910 when his father became ill. Henry III built spectacular late Romantic organs at: Liverpool, Anglican Cathedral (1923–26; reb. Harrison and Harrison, 1977; now 5/141) and London, Westminster Cathedral (1922–32; rest. Harrison and Harrison, 1984; now 4/78). Not technologically gifted, he secured the aid of others to implement modern refinements, including Ernest M. SKINNER and G. Donald HARRISON. However, his personal taste did not change; Henry III was resolutely against the NEOCLASSICAL ORGAN, and he developed the habit of going to concerts on such instruments in order to make a point of walking out on them. This attitude ultimately isolated the firm at a time (after World War II) when the ORGAN REFORM MOVEMENT was beginning to take hold in England. He was followed in the firm by his son Henry IV (b. 1927; Kirkwall, Orkney, St. Magnus Cathedral, reb. 1926 Willis III, 1970–71; now 3/41), who retired in 1997; the firm is now directed by David Wyld. Recent activity has concentrated on restoration and relocation (Sutton Coldfield, Wylde Green, Emmanuel Parish Church; 1932 Willis III organ from Kensington, Seventh Church of Christ, Scientist; 3/46).

"Father" Willis was a successful organbuilder who built up a highly successful family firm through a combination of well-made instruments, innovation and self-publicity. For many Victorian organists, the organs of Henry Willis represented an ideal of tonal and mechanical refinement. Willis was a consummate technician; it is both the strength and the weakness of his instruments that he approached tonal as well as mechanical questions as technical problems to be solved. Some contemporaries felt that his concert organs were more successful than his church organs on account of the orchestral character he imparted to all his instruments, but there is no denying that he was the first English builder to make church organs capable of filling vast spaces with sound.

Willis built over two thousand organs. His claim to be considered among the great artist-engineers of his time is borne out by his concert organs (Bristol, Colston Hall, 1900; 4/130; reb. Norman and Beard, 1905; reb. Willis III, 1936; dism. 1950) and his principal cathedral instruments, including Salisbury, Blessed Virgin Mary (1876–77, 4/65, rest. Harrison and Harrison, 1978); Truro, St. Mary (1887, 4/45, rest. Mander, 1991); and Lincoln, Blessed Virgin Mary, reb. 1851 Allen/1887 Wordworth and Maskell organ (1898; 4/64; rest. Harrison and Harrison, 1998). Few survive unaltered; exceptions include Reading, Town Hall (1864, 1882; 4/37; rest. Harrison and Harrison, 2000), Preston, St. George the Martyr (1865; 3/37), Islington, Union Chapel (1878; 3/37; rest. Monk and Gunther, 1946), Blenheim Palace (1891; 4/56), Oxford, Town Hall (1896–97; 4/35), and Hove, Town Hall (1897;

4/36; to Borehamwood, Haberdasher's Aske's School, 1962).

See also **Willis Floating and Fisk Servopneumatic Levers**

Alastair Disley
Nicholas J. Thistlethwaite

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WILLIS FLOATING AND FISK SERVOPNEUMATIC LEVERS

Two devices designed to offset the resistance caused by the weight of tracker actions in larger organs. The resistance, created by the mechanism and the pressure of the wind against the pallets, occurs when the player depresses one or more keys while playing the instrument. Among the nineteenth- and early-twentieth-century solutions to this problem were the Barker lever and pneumatic and electric actions. The Barker lever, one of the earliest but most enduring options, has two major disadvantages. First, while it is not completely insensitive to touch, it is similar to a light switch in its being more or less either "on" or "off," with nothing in between. Second, it is quite noisy, often being heard over the pipes sounding like the incessant clack of a set of castanets.

Variations of the Barker lever, known as the "floating" and "servopneumatic" levers, overcome these two major hurdles in an almost magical fashion. The credit for the development of the lever goes to two organbuilders living a century and an ocean apart.

The floating lever was originally developed during the second half of the nineteenth century, probably by Vincent Willis (son of Henry Willis) and used in half a dozen or so instruments built by his father at the time. Vincent took out a patent for "improvements in the action of keyboard instruments" (1884), an improvement on Henry's 1853 patent. When tubular-pneumatic action became the cutting-edge system, the Willis floating lever was abandoned as redundant.

Unaware of the Willis floating lever's existence, Stephen Kowalyshyn of the American firm of C. B. Fisk developed an uncannily similar device (the servopneumatic lever) in the mid-1980s. Based on an experimental swell mechanism designed by E. M. Skinner, it was refined by Kowalyshyn and other members of the Fisk

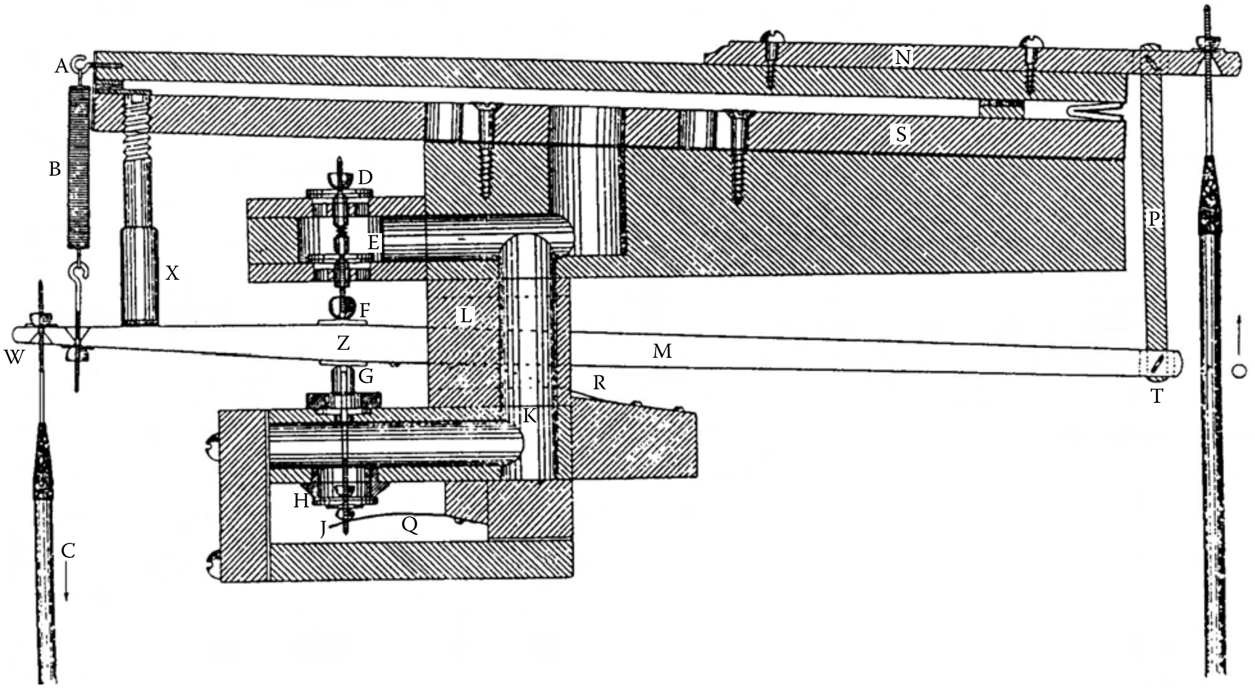

Fig. 81. Willis Floating Lever.

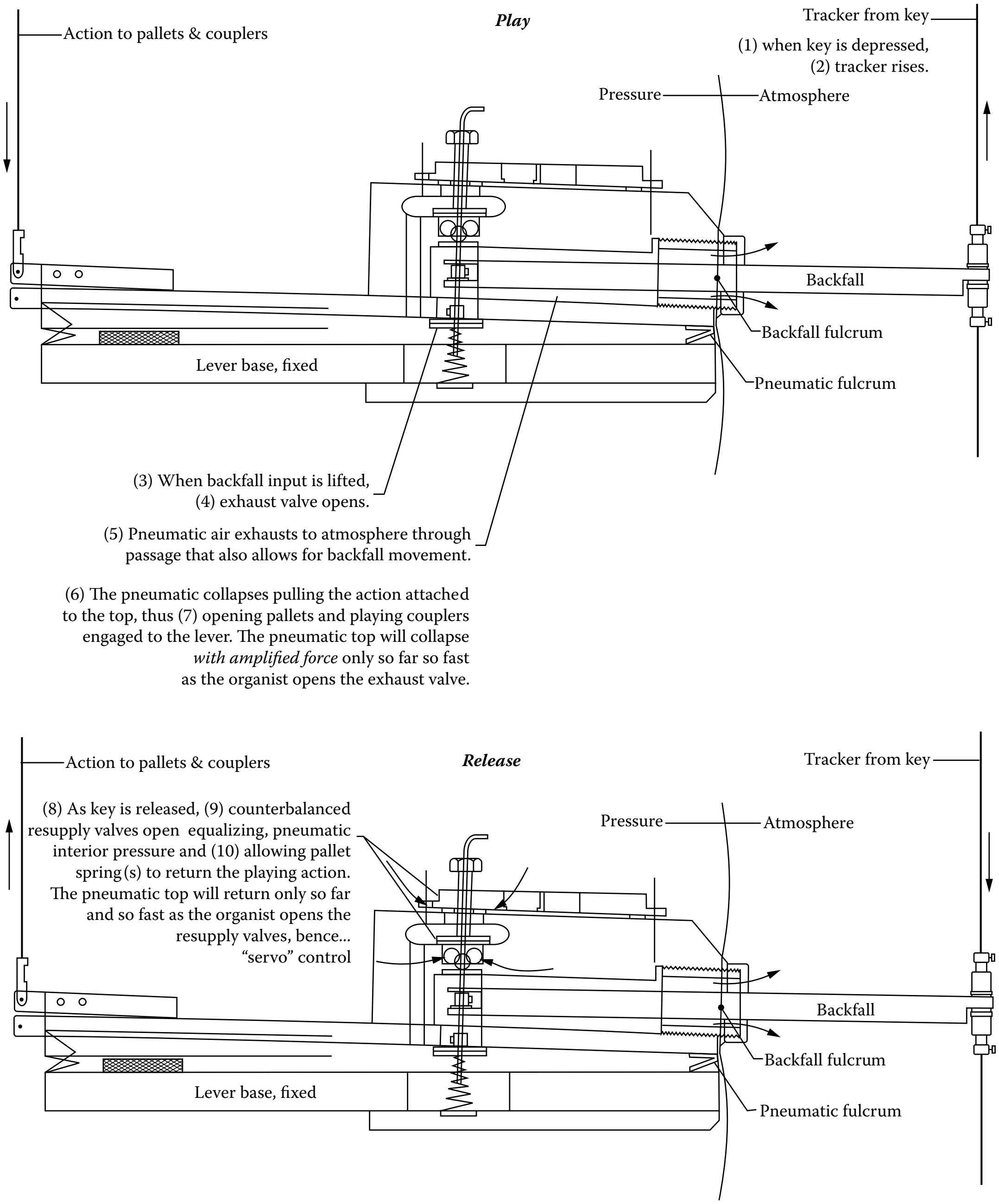
Action to pallets & couplers
Play
Tracker from key
(1) when key is depressed,
(2) tracker rises.
Pressure
Atmosphere
Backfall
Backfall fulcrum
Lever base, fixed
Pneumatic fulcrum
(3) When backfall input is lifted,
(4) exhaust valve opens.
(5) Pneumatic air exhausts to atmosphere through
passage that also allows for backfall movement.
(6) The pneumatic collapses pulling the action attached
to the top, thus (7) opening pallets and playing couplers
engaged to the lever. The pneumatic top will collapse
with amplified force only so far so fast
as the organist opens the exhaust valve.
Action to pallets & couplers
Release
Tracker from key
(8) As key is released, (9) counterbalanced
resupply valves open equalizing, pneumatic
interior pressure and (10) allowing pallet
spring(s) to return the playing action.
The pneumatic top will return only so far
and so fast as the organist opens the
resupply valves, bence...
"servo" control
Pressure
Atmosphere
Backfall
Backfall fulcrum
Lever base, fixed
Pneumatic fulcrum

Fig. 82. Fisk Servopneumatic Lever.

staff and first applied in the firm's organ for the State University of New York–Buffalo's Slee Hall (1990). Since then the lever has been used with great success in several Fisk organs, culminating in its magnum opus for Lausanne Cathedral (2003; 5/124 ranks).

The floating/servopneumatic lever works in relation to the Barker lever much as a rheostat (a current regulator based on variable resistances) does in relation to a light switch. As the player's finger depresses or releases the key, the chest's pallet follows its motion, opening or closing only as slowly or as rapidly as the motion of the key allows. In addition, the lever prevents the increase of resistance on the key regardless of how many stops are drawn or how many divisions are coupled together. Despite the loss of some of the touch or "feel" of a tracker action, the organist gains greater control over the speech of the pipes because of the reduced "pluck." Finally, there is almost no noise discernable from the machine, as its response is instantaneous for all practical purposes.

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WINDBOX

See Regulator; Windchest

WINDCHEST

A structure located beneath the pipes, traditionally parallel to the KEYBOARD and as wide as the CASE it is located in is wide, but far less deep or tall. The windchest is the place to which the air, generated under pressure by whatever WINDING system is in use, goes. In one type, the bottom half of the windchest is the holding area for the air; a pallet, valve, or other device leads to the upper area, which leads directly to the TOE of the pipe's FOOT (flue pipes) or BOOT (reed pipes). When the device is closed, the particular pipe or pipes do not sound. When a combination of the organ's KEY ACTION and STOP ACTION opens that device, air flows out of the bottom area into the top area and then directly to the pipes, always under pressure. Although the windchest is an essential and intuitive part of organ technology (it's the place where the air goes before it sounds a pipe), it is vulnerable to insufficient wind (the sound will falter or fail altogether), excessive wind (the air backs up in the WINDTRUNK leading to it and causes a "bump"), or faulty actions (mechanical failure, leaks). The historical development of the windchest ultimately depends on the actions and winding that control it.

The windchest appears from the beginning of organ history, in the HYDRAULIS. Without a windchest; the hydraulis would have had no way of controlling the air pressure produced by the cistern and lever winding system, and sound generation would have become erratic. (The *reductio ad absurdum* alternative is a keyless, cisternless "human syrinx" in which one person—now a "component"—blows one note when signaled to do so; thus, a piece is produced by individuals playing in turn, each note's duration limited by its player's breath.). The pipechest (as the early windchest was called) received its wind from the exhaust conduit beneath it and held the air until the path to a particular pipe was opened by a key operated by a player (two at most). More than a thousand years later, Theophilus described an instrument with similar principles; the winding was now provided by feeder BELLOWS, which forced air into channels meeting at a central duct; the air then traveled through a central windtrunk to the windchest. A control valve in each bellows opened as air came through but closed once the pressured air was exhausted, preventing a loss of pressure and faltering sound. These flaps were one of the first devices in the instrument's CONDUCTOR SYSTEM located *outside* the windchest with impact on the air *within* the windchest; there would be many others over the century.

Medieval "blockchests" were windchests that had evolved into a pallet box (lower half) and a groove (upper half). As before, pressured air entered the box; it would flow into the groove when a pallet, a kind of valve between the box and the groove held in place by a spring, was engaged by a key being depressed on the keyboard. A sticker attached to the front of the key depressed the front of the pallet, opening the space between the two halves, and allowing air to reach the pipes. Each key had its own groove or channel, running from front to back of the organ; these needed to be airtight to prevent CIPHERS, RUNS, or other causes of faulty speech. Small MEDIEVAL AND RENAISSANCE ORGANS were the first to provide stop actions, permitting the Blockwerk to be broken into groups of sonorities that could be used in different combinations or alone. The first stop action, part of the slider-chest, opened or closed ranks (STOP CHANNELS, lying parallel to the keyboard) of pipes of one type, depending on whether the holes in a given SLIDER (lengthwise and parallel to the keyboard) were aligned with the pipes; if open, it was possible to sound any pitch of that rank. Originally the sliders had to operated manually, but subsequently they could be controlled by a DRAWSTOP (stop-knob), attached mechanically to allow movement "on" or "off." A later Renaissance invention, the spring-chest, retained the pallet box, but the groove gained a secondary valve and spring assembly sealing a narrow channel to the pipes. This valve was kept closed by the spring unless a stop in the form of a wooden "comb" (stop-lever bar), running lengthwise and parallel to the keyboard, was "put on" at the CONSOLE. Resting on springs, it pushed the secondary valve down to allow the air to flow into the pipes; it remained open until the stop was taken off. The slider-chest and spring-chest were popular at different times and different places.

The slider-chest was simpler in concept and manufacture (and smaller), but less durable (and vulnerable to warpage). The spring-chest was more complex and more sensitive to weather conditions (and larger), but longer lasting and (it is thought) more able to stabilize tuning. Countries such as Italy remained divided on their preference; by the eighteenth century, the spring-chest was considered old-fashioned in northern organ building.

The larger BAROQUE ORGAN led to the development of sophisticated mechanical key actions (balanced and suspended), with their combinations of rollerboards, rollers, trackers, squares, backfalls, and other elements allowing cases to grow with the increasing numbers of pipes and stops. Windchests grew accordingly, but their structure remained as before: pallet box and groove, fed by bellows and operating with valve and spring assemblies. The bellows changed as well, moving from a single or multifold WEDGE BELLOWS (fifteenth century), with sidebars to the pulley-operated lantern-bellows and box-bellows types, to the RESERVOIR and feeder-bellows of the eighteenth century. The reservoir held air pumped directly into it from below; weights on top performed the function of pressuring air into the windtrunk, rather than doing so directly by hand (or foot). A nonreturn valve in the bellows (located below the reservoir) acted much as the control valves had in THEOPHILUS's organ. Besides the added capacity for air of a reservoir, the reservoir added another level of control over the air, smoothing out its path through the system. But the windchest remained the same.

The nineteenth century saw technological innovation at a remarkable rate, and this touched all elements of the organ. In the case of the windchest, two concepts were crucial: pneumatics, and the VENTIL chest. Pneumatics took several forms; first came the BARKER LEVER, which combined a windchest-like device with a miniature bellows, or "motor." When pressured air entered the groove, it traveled forward into a duct that opened the bellows downward, thereby pulling down a tracker that led up to a separate pipechest pallet to sound the pitch. When the key was released, the pallet box closed off the flow and an exhaust valve was raised to allow pressure to dissipate. TUBULAR ACTION used motors near the key itself and a pair of motors in the by-now expanded pallet box, but the result was similar, with the air entering the familiar groove. Late in the century, electro-pneumatic action added electromagneticism to the process, replacing the key motor; but the two-motor pallet box remained more or less intact. Following earlier practices such as placing a MOUNTED Cornet on its own windchest, ROMANTIC ORGAN builders such as Aristide CAVAILLÉ-COLL began to provide single DIVISIONS with their own windchests, as well as the FONDS, ANCHES, and the various "Grand" and PLEIN JEU choruses. Pipes that could not fit into the main case were sometimes placed above their own so-called offset chest.

The ventil chest provided a separate air supply for each stop; the key action controlled the sounding of notes by itself. The most significant ventil system was the mid-century cone-chest, a mechanically simpler, easier-to-build alternative to the slider-chest (at least in the view of its proponents, mostly German builders). As before, a stop channel ran lengthwise in parallel with the keyboard, feeding one rank; if the stop was open, air was fed into it. But there were no KEY CHANNELS, instead, a mechanical key action led to a single cone-chest, controlled by a valve resting on a rod below, one for each note. If a key was depressed, all of its valves (cones) were lifted, freeing the air channel (located within the chest, starting from below) to the pipes; if a particular stop was open, the wind would enter the air channel, which ran behind the stop channel into the pipes. Related systems, such as the disc-based bellows-chest and membrane-chest, were less common, but had their devoted followers.

Three other windchests types have become part of the organbuilder's repertoire in the last century or so. The PITMAN CHEST of ERNEST M. SKINNER is a single electro-pneumatic chest with stop channels and a complicated set of pathways and small motors; the advantage of the chest lies in the synchronized used of pneumatics at multiple levels, in which the absence of air pressure is used to further the system. The pitman itself is a small unit held in place by equalized pressure and gravity. The Austin Universal Windchest is an electro-pneumatic chest of less complexity, designed to allow greater access into the windchest itself for maintenance purposes, even during performance. The wind inside it is available to all pipes, while the action itself is located toward the front of the chest; the Austin chest incorporates the roles of reservoir and windtrunk. Finally, the development of the UNIT ORGAN gave each pipe its own control and total flexibility in terms of identity. As long as there were still pipes to be winded in the concert and THEATER ORGANS of the twentieth century, an electrically blown windchest was a necessity. Once the ELECTRONIC ORGAN took hold, the windchest became a relic—except to the ORGAN REFORM MOVEMENT, which sought to revive the slider-chest and spring-chest in keeping with its goal of authenticity. The more recent neoromantic phenomenon has expanded revivalist builders and restorers' interest to the various pneumatic chests of the nineteenth century.

See also **Action; Windchest, Direct-Electric**

RICHARD KASSEL

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WINDCHEST, DIRECT-ELECTRIC

A trademark for a type of WINDCHEST invented between 1915 and 1917 by the WICKS Organ Company of Highland, Illinois, as the heart of an all-electric system called Direct-Electric ACTION. It is a "universal" chest (filled entirely and continuously with an electric BLOWER), without key and stop channels. Internal electromagnetic valves admit wind to the pipes through borings in the top of the chest. The chest action was successful from the beginning; although the system has undergone refinements and technological change over the years, the earliest versions are compatible with the most recent. Wicks continues to make all but the solid-state parts in its shops.

In the basic Direct-Electric system, a contact wire, one for each key and pipe, handles the current for each chest magnet. The large console cable goes directly to the chests; depressing a key opens the valve so that the air under pressure in the windchest enters the pipe. Besides the ease of maintenance associated with a universal chest (first patented by John T. AUSTIN in 1892), WIND PRESSURE is the same for all pipes, whatever their size.

Electromagnetic units originally used a felt and leather valve pad attached to an armature via a threaded wire. The magnet and armature configuration was easily powered by the contact wires but absorbed little permanent magnetism. A flat leaf spring held the valve shut when not in operation, and a felt stop limited the armature's motion and prevented it from hitting the core. The valve pad rested on a wood "valve seat" attached to the underside of the toe board; a ring with a sharp edge surrounding the boring, it was intended to provide an airtight seal when the valve pad contacted it. There was enough motion when the magnet was energized to lift the valve a considerable distance off the seat, uncovering the boring and presenting little hindrance to the flow of wind into the pipe.

Originally there were no satisfactory all-electric valves for the largest pipes, because of insufficient power to uncover large borings; Wicks used electropneumatic valves. "Balanced valves," used after 1933, consist of a small box covering the ring inside the chest, with two or four large holes in pairs on opposite sides of the box. These holes are covered by pairs of large valves connected to each other by a rod passing through the box; one of each pair opens inward, the other outward. The power needed is reduced, since the air pressure on the two valves is balanced; a small magnet can open a large pair of valves. The balanced valves sometimes leaked slightly, which limited their use on reeds; in the 1970s they were replaced by two or more regular chest valves, covering a number of smaller borings, for each pipe.

There was a tendency for the chest valves to bounce on closing, leading to an occasional "burp" on the release of a note, especially noticeable on reed pipes. "Bounceless" valves for reed pipes were designed in the 1940s to overcome this. These have an extra lever that carries the valve, connected to the armature with a friction spring that permits the heavy armature to bounce without carrying the valve with it.

The sizes of the borings under the pipes had been standardized by the 1940s. In response to criticism alleging that Direct-Electric action was "too fast," the borings were made smaller in the 1950s, as this slowed down the speech of the pipes while also concealing the "burp" caused by bouncing valves (and by improperly adjusted relay units). But voicing difficulties resulted, and in 1962, during low-pressure voicing experiments, the older sizes were rediscovered and restored.

In 1964 the valve seat was eliminated; the valve pad was made larger and seated directly on the underside of the top board. At the release of a note, the increased air cushion (under the valve) and a diode (which allowed the self-induced current to dissipate through the coil itself) combined to slow down the valve closing and removed all traces of bouncing. These improvements came at the same time as the introduction of the solid-state relay, which acted instantaneously, and gave enough precision to the valves opening and closing in response to the keyboard to enable some control of chiffing and attack in the low-pressure voicing then being introduced.

As the action is all-electric, it imposes no practical limitation on wind pressures used (the upper limit is about 12"). Since there are neither key nor stop channels in the chests, there is no mechanical limitation on the arrangement of the pipes. Main chests are built with separate top boards for each rank (or group of two or three small ranks); this permits longitudinal ribs that are, however, pierced with large holes to prevent wind being robbed by larger pipes. Access for service is through removable top board sections so they can be set on the floor. The chests have always been made of pine or spruce, with poplar preferred for the top boards; some chests made during the 1940s used other woods because of wartime shortages.

By the 1920s, tracker action had few defenders; Direct-Electric chests were usually compared with electro-pneumatic systems. Criticisms included noisy action, "too rapid" a response, bouncing valves, and incorrect pipe speech. (The last two were often justified, before the introduction of diodes and during the periods of experimentation with small borings.) Advocates emphasized reliability and longevity, no re-leathering, efficient use of space, and adaptability to low wind pressures. Since the 1950s the comparisons have shifted to tracker action organs. Modern critics of Direct-Electric action (there were spirited debates in the pages of the *American Organist*, *Diapason*, and *Organ Institute Quarterly*) cite the absence of intimate connection between player and organ, lack of control over pipe speech, and voicing problems caused by lack of tone channels. Modern defenders make claims similar to its earlier advocates, citing as well the benefit of precise pipe speech like that found on channeled chests. Further, they question the objectivity of claims that only tracker action permits influencing attack by keyboard technique. Despite criticisms, other all-electric chest actions have come into use since the 1920s, including those offered by suppliers to the organ-building trade; these are used by some builders in new instruments and in the repair and renovation business.

Barnes is the best source for illustrations of the earlier Direct-Electric system. In evaluating his claims, readers should remember that he was not an organ-builder (see the introduction to the second edition).

John E. Sperling

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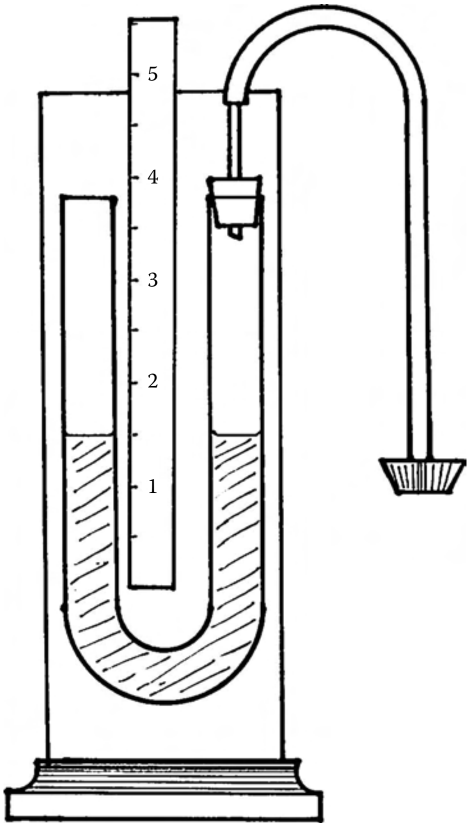

Fig. 83. Wind gauge.

WIND GAUGE

A device to measure the wind pressure driving organ pipes; also called wind indicator. In the ancient HYDRAULUS, air was pumped until bubbles erupted and floated to the surface of the water surrounding the capture bell reservoir. The depth of the spill hole in the capture bell served both to regulate and gauge the pressure. As the organ evolved, bellows-based reservoirs came into use and water-driven reservoirs became obsolete. The next form of wind gauge used a weighted bellows reservoir; CALCANTS would keep pace so that a mark on the movable section of the bellows would align with a stationary mark.

However, the use of water to measure air pressure was not lost. During the Renaissance, Italian scientists began to work with water columns driven up by air pressure. Evangelista Torrecelli (1608–1647), a student of Galileo, developed the first water-column manometer to test low-level air pressures. As engineering flourished through the Industrial Revolution, the Torrecelli manometer was reshaped into a *U*-shaped tube. When air pressure was placed on one side of the water at the bottom of the tube, the water would rise up the other side according to the pressure applied. Organ wind pressures then became measurable in "inches of water column." Today the shorthand among organbuilders and technicians is simply WC, expressed as 3”WC, for example. In countries that use the metric system, the centimeter expresses the wind pressure, e.g., 5cmWC. Alternative expressions such as “inches of water” and WP continue to be encountered.

Wind gauges of the *U* type are read by measuring the distance from the surface of the water in one arm of the tube to the surface in the second arm. Organ technicians usually add a drop of food dye or ink to make the liquid more visible. Ingrained use of the English-American inch standard continues, but a majority of today’s builders have embraced the European centimeter standard, as many suppliers of modern pipework work on that continent.

Wind gauges in this modern era have evolved: flexible metal air chamber “aneroid” (waterless) mechanical dial gauges, then aneroid magnetic mechanical (Magnihelic) gauges, and now to electronic gauges with digital readouts. All are still calibrated against a water-filled *U* tube manometer set at near–sea level atmospheric pressure. Since mechanical gauges often lose accuracy with transport vibration and mechanical shock, they are routinely recalibrated and checked with a water manometer before any job is undertaken.

ALBERT F. SEFL

WINDING

The process of supplying pressured air to organ pipes, producing sound. Over the centuries, builders have applied ever-increasing engineering competence to the problem of winding. BELLOWS were enlarged, weighted, sprung, ribbed, leveled, and made complex with a wide variety of air valves, feeders, wind conductors, and shock absorbers. These changes were made in an effort to gain steadier wind for the organ; there is evidence that, as time went on, winding systems indeed became steadier with each technological improvement. Indeed, it seems unlikely that any pre-1900 organbuilder set out to achieve greater unsteadiness of wind than the engineering abilities of his time would allow.

The problem even received the attention of Johann Sebastian Bach, who made a list of recommendations for the rebuilding of the organ at Mühlhausen in 1708. His first three recommendations concern the bellows and chests, and he wanted the unsteady wind problem solved so that all three manuals and pedal (with 32’) would have a steady sound even when large groups of stops were drawn. Clearly, Bach wanted more steadiness than the organ had, and he made this the priority. But it is not possible to know what sort of steadiness he wanted or would have accepted; how an organ sounded several hundred years ago and how it was perceived by organist and listener is now irretrievably lost.

The goal of absolute steadiness of wind and sound was finally achieved in the late nineteenth century. The electric BLOWER and sophisticated wind REGULATORS provided wind so steady and free of vibration that any size chord, playing technique, or REGISTRATION could be used without fear of pitch distortion or the “bump” of an insufficiently winded stop. It was not long, however, before the long-sought goal of steadiness of wind was called into question; by the 1960s, some organbuilders were viewing steady wind as ahistoric and dull. Bellows and winding systems that had been discarded centuries ago were revived and installed in new organs for the express purpose of achieving unsteady wind. What Bach had appeared to discard, we now embraced, and every organbuilder was forced to rethink the problems of winding in a new light. Not having the benefit of the trial and error development that went into the original winding processes, the revived systems were applied as copies or experiments. Some were notably unsuccessful, but the work has continued as each organbuilder struggles to achieve just the “right kind” of unsteadiness. Free from the limitations of past technologies, a modern organbuilder is able to choose from among a wide variety of historic and national styles for the first time.

The issue of steady versus unsteady wind raises numerous questions. Is a “perfect” winding system one that is steady and without detectable flaw, or one that reflects the historic period that a particular instrument is attempting to replicate? Is today’s listener distracted or enlightened by being able to hear either steadiness or unsteadiness in the organ, especially as some fine new instruments have controls that make it possible to change from steady to unsteady wind? Is such a control equivalent to an electronic device that allows for conversion from classical to Romantic organ sounds, or is it a valid new device for the pipe organ?

The value of having organs with a wide variety of winding systems is that it enriches our knowledge, as long as it is understood that absolute authenticity in historic matters is not possible. We can only allude to the situations of the past rather than reproduce them.

CHARLES HENDRICKSON

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WIND PRESSURE

Prior to the late nineteenth century, pipe organ wind pressures ranged mostly in the area of 2" to 4" of water column, as measured by the WIND GAUGE. Organs were pumped by hand and foot power, and tracker action was the norm. Together, these two elements limited the pressures that could be generated. Attempting to play a straight tracker organ at wind pressures higher than 4" would be hard on the fingers; coupling multiple manuals at such pressures would require great playing effort.

With the introduction of steam, water power, gas engines, and electricity, wind pressures increased, since there was unlimited power to operate the blower, and fingers became detached from operating the valves in the windchests. Playing an electric action organ on 2" wind pressure was no more difficult than playing one on 25".

Beginning in the late 1800s, wind pressures gradually rose until they reached a peak of 100" in the MIDMER-LOSH/Emerson RICHARDS organ at the Atlantic City, New Jersey, Convention Hall (1929–32; now Boardwalk Hall). Such extreme pressures are rare, and most organs built between 1910 and 1950 would have wind pressures in a range of from 4" to 10", with some big reeds up to 25". With the revival of tracker action in the 1950s and '60s, wind pressures dropped to lower levels, and many instruments operated in an extreme range—below 2", perhaps as low as 1" during the 1960s. Such experiments were short-lived, and by the 1980s most pipe organs were being built and voiced with pressures ranging from 3" to 4". These years from 1950 to 1980 marked the period of Baroque revival with tonal designs reflecting a modern interpretation of organ styles before 1750 and, in many cases, an anti-Romantic stance. The results of this movement were interesting and informative, but many neobaroque instruments, rather than reviving the actual style and sound of the earlier designs, produced an entirely new type of instrument with a character and sound all its own. The Baroque revival did not (in essence could not) produce any actual Baroque instruments, but the results were important, far-reaching, and remain with us today. The implementation of early tonal schemes, voicing, performance, and organ architecture has been widespread and of inestimable importance in current organbuilding.

In the 1980s, wind pressures began rising again. Echoing the late nineteenth century, organ design has begun to move into neoromantic areas as neobaroque (not Baroque) ideas fade from prominence. Aristide CAVAILLÉ-COLL is the talk of the day, and builders are scrambling to understand everything about the French Romantic organ as they create their own interpretations of it. The American classic organ (1930–60) is having a similar revival, claiming a new validity after the interruption in its development during the neobaroque era.

The demise of the large pipe organ predicted some years ago has not come to pass; rather, instruments with powerful voicing, high wind pressures, and eclectic design have returned to the scene. Large tracker organs are being built with equipment to assist playing on higher wind pressures, and electric-action instruments are attaining pressures above 7", something not seen for a half century. It is uncertain where the current trend in wind pressure is going. Perhaps the ever-widening options available in contemporary organ building will be reflected in a broad and highly individual use of wind pressures. Some builders stay within between 2-1/2" and 4", while others will base their choices on the sonic power needed or the tone color desired—a French Horn stop needs at least 10" wind pressure to be successful.

CHARLES HENDRICKSON

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WINDTRUNK

A wooden, metal, heavy cardboard, or (recently) plastic duct or tube conveying wind from the BELLOWS (or blowers) to the WINDCHEST, directly or via a REGULATOR OR RESERVOIR; also called wind line. Depending on the size and technology involved, an instrument may have several trunks of different sizes; a pair may divide to feed air from both sides of the case, or others may connect to pneumatic actions (e.g., BARKER LEVER). In many organs, a CONCUSSION BELLOWS intercepts the wind supply from the trunk and smoothes out the brief surges and vacuums before it continues its flow. Many traditional instruments place a wind-driven TREMULANT at the outlet of a trunk from the windchest, which produces a vibrato effect that can be varied according to taste. This effect can usually be canceled by a CONSOLE stop.

In the case of a BLOWER, the connection between its box and the main trunk's intake is sealed off to protect tuning from the blower's heated air. This trunk's intake and exhaust use leather to help silence the noise of the airflow. The secondary trunks between the regulator or reservoir and the windchests are narrower and shorter than the main trunk.

With the onset of electro-pneumatic action, windtrunks were no longer as prominent in organ building; with full electrification, the trunk was completely replaced by the wire.

RICHARD KASSEL

WINDWAY

The channel in the FOOT of a FLUE pipe that takes air from the toe to the mouth. In a metal flue pipe, *windway* is synonymous with *flue*, and refers to the entire hollow interior of the foot beneath the LANGUID. In a wooden flue pipe, the windway is the part of the channel that takes air from the foot and moves it forward to the THROAT, behind the cap. The shape of the block forms the windway and has some effect on the sound of the pipe.

ALASTAIR DISLEY

WINKER

SEE CONCUSSION BELLOWS (WINKER)

WITTE

Dutch family of organbuilders, successors to the BÄTZ firm. Christian Gottlieb Fried(e)rich Witte (b. Rotenburg, Germany, 1802; d. 1873) began his apprenticeship with Christian Heinrich Bäthmann in Hannover at age fifteen and stayed for seven years. In 1824, Witte traveled by foot to the Netherlands to visit organs and organbuilders and to seek his fortune. He first found a position with an organbuilder in Amsterdam, then joined the Bätz workshop in Utrecht two years later. At the time, brothers Jonathan Bätz and Johan Martin Willem Bätz (the third Bätz generation) were running the business. Witte soon had the confidence of his employer and in 1830 supervised the installation of the large organ in the Ronde Lutherse Kerk in Amsterdam. Johan Martin Willem left the family business in 1831; two years later Jonathan Bätz and Witte became partners. Witte strengthened ties with the Bätz family in 1839 when he married the granddaughter of organbuilder Gideon Thomas Bätz (uncle of Jonathan); he took over the business when Jonathan Bätz died in 1849 (the firm remained "J. Bätz and Company"). Johan(n) Frederik Witte (1840–1902), the eldest son of Christian Gottlieb Friedrich, began his apprenticeship with his father around 1856; in 1869, Johan Frederik became a partner in the business. After his father's death, he carried on until his own death. The business was liquidated one year later (1903).

Among Protestant denominations in the major cities (Amsterdam, The Hague, Rotterdam, and Utrecht), the Wittes were the preferred organbuilders for new instruments or renovations to older organs. Like the Bätz family before them, their work was expensive but of high quality and built in a craft-oriented workshop with little or no reliance on outside suppliers for organ parts. Slider windchests and mechanical key actions (albeit assisted by BARKER LEVERS on two of the larger instruments built in the 1880s) were the norm. From 1850 to 1902, the firm built eighty-six instruments; twice the production of the Bätz firm during the first half of the nineteenth century. This reflects Christian Gottlieb Friedrich's excellent reputation as well as the increasing demand for organs in the Netherlands at that time. Among the instruments built by the Wittes are eight three-manual organs (the last two by Johan Frederik alone): Rotterdam, Zuiderkerk (1850; destr. 1940); Hoorn, Grote Kerk (1851; destr. 1878); Gorinchem, Grote Kerk (1853); Delft, Oude Kerk (1857); Naarden, Grote Kerk (1862); The Hague, Nieuwe Kerk (1867, in old case); The Hague, Grote Kerk (1882; dism. 1968); and Amsterdam, Oude Lutherse Kerk (1886).

The Witte organs brought the Bätz firm to a leading position among Dutch organbuilders active in the mid- to late nineteenth century. Their instruments were conservative, particularly in comparison to builders in England, France, Germany, and even a few in the Netherlands; the Delft, Gorinchem, Hague, and Naarden Nieuwe Kerk organs still had separate Rugpositief divisions. But modern trends are evident, particularly on larger instruments: detached consoles, combination pedals for windchests divided into foundation and reed/mixture stops, Barker levers, swell boxes, magazine bellows, and tuning slots on pipes. Over time, one also finds more power, rather than brilliance, in the tutti. While some of these developments may seem to reflect French influence, Witte organs were much closer to German Romantic lines and were always well-suited for the accompaniment of congregational singing in Dutch Protestant churches.

JAMES L. WALLMANN

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WOLF FIFTH

When tuning in a tempered system other than equal temperament, an interval that, although it looks like a fifth on the twelve-note-per-octave KEYBOARD, is too sour to use as a fifth. In a circle of twelve fifths, it would be placed at the half-way point. In PYTHAGOREAN INTONATION, a wolf fifth is smaller than pure by a PYTHAGOREAN COMMA (23.46 cents, about one-eighth of a whole tone); in the early fourteenth century it would have been located between G♯ and E♭ (i.e., D♯), but in the late fourteenth and early fifteenth centuries between B and G♭ (i.e., F♯). In a MEANTONE TEMPERAMENT a wolf fifth is larger than pure because the good fifths are tempered at least as much as in equal temperament. When meantone temperaments first came into use in the fifteenth century, the wolf fifth was located between C♯ and A♭ (G♯) and or between G♯ and E♭ (D♯); but during the sixteenth century the latter location became standard for instruments with twelve notes per octave. JUST INTONATION (never used to any significant extent on keyboard instruments) entails three wolf fifths on a normal keyboard, one of which must be between two diatonic notes; in theoretical writings it is normally assumed that these would be D and A, or G and D.

See also **Tuning and Temperament**

MARK LINDLEY

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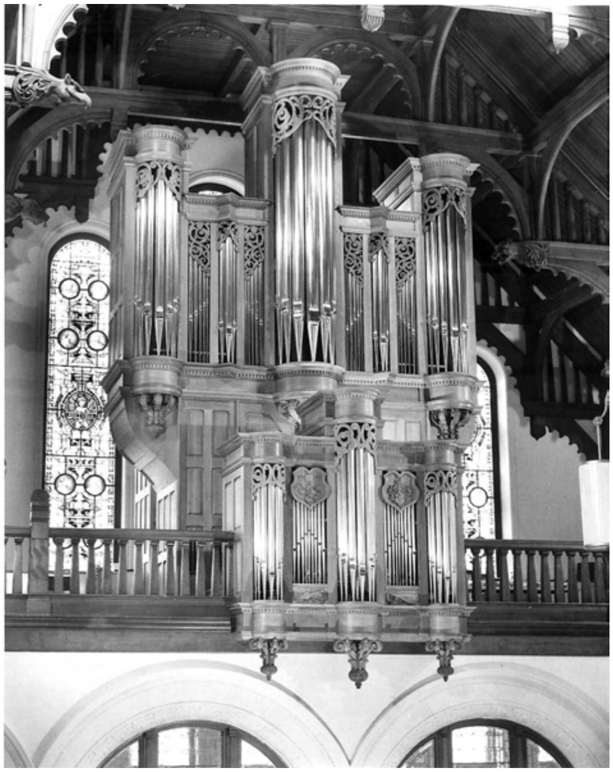

Fig. 84. Hellmuth Wolff organ.

WOLFF, HELLMUTH (SYLVIO GUSTAV) (B. 1937)

Swiss-born Canadian organbuilder. Wolff (b. Zurich, 3 Sep 1937) began an apprenticeship with METZLER in 1953, then worked for several builders, including Charles B. FISK, Otto HOFMANN, and RIEGER. His work with two leading American organ reformers gave him the necessary background to go to work for CASAVANT FRÈRES in Canada in 1963. Casavant had at been first unwilling to compete with the tracker organs made by Rudolf von BECKERATH and other builders imported by churches and musicians in the 1950s; changing strategy, Casavant hired Wolff and two other Europeans (Karl WILHELM, 1960; Gerhard BRUNZEMA; 1972) in an attempt to bring itself up to date. Wolff and Lawrence I. PHELPS designed the organs at St. Pascal de Kamouraska, Québec (1964; 3/29), Toronto, Our Lady of Sorrows, and Montreal, Marie-Reine-des-Coeurs (1965; 2/29). He left to go to Geneva to work as a designer and voicer, but returned quickly to Canada in 1966, first to work with Wilhelm, by now also an ex-Casasvant employee, and then to set up his own workshop in Laval, a Montreal suburb (1968). In 1981, the firm was incorporated as Hellmuth Wolff et Associés; James Louder, who had begun working for Wolff in 1974, became a partner in 1988.

Wolff's work demonstrates a virtuosic command of historical styles as well as the ability to blend elements when appropriate. He has built mechanical organs in several modes: François BÉDOS DE CELLES–French classical, for Montreal, McGill University, Redpath Hall (1981; 3/37); English Baroque, for Montreal, St. John the Evangelist (1984; 2/27; French reeds); CAHMAN–Scandinavian Baroque, University of Toronto, Knox College (1991; 3/32); and eclectic "American classic," Kalamazoo, Michigan, Kalamazoo College, Stetson Chapel (1987; 3/44; French/German, mech./electric). A continuo organ built for Vancouver, Early Music (2001; 1/5, including three divided stops) has a transposable keyboard, variable temperments, and four possible pitch levels (382, 415, 440, and 485Hz). His instrument for Lawrence, University of Kansas, Bales Recital Hall (1996; 3/45, mech./electric; after A. SILBERMANN) was a successful collaboration between organbuilder, acoustician, and architect, who created a new facility with an organ planned from the outset.

Wolff's instruments usually reflect the French aesthetic of his adopted home. Among other instruments are: Oka, Quebec, Notre-Dame-du-Lac (1973; 2/20); New York City, St. John the Evangelist (1974; 3/26); Montreal, St. John's Lutheran (1983; 2/15; German); Oyster Bay, New York, Christ Church (1986; 2/32); Indianapolis, Christ Church Cathedral (1992; 4/50, mech./electric, eclectic); Montreal, Visitation of the Blessed Virgin Mary (reb. 1835 S. R. Warren; 1993; 2/27; Italianate); Halifax, Nova Scotia, Atlantic School of Theology, St. Columba Chapel (1994; 1/10); Northbrook, Illinois, St. Giles Episcopal Church (1994; 2/29); Cedar Falls, University of Northern Iowa, Gallagher-Bludorn Performing Arts Center (2000; 2/31); Greencastle, Indiana, DePauw University, Kresge Auditorium (2002; 3/41); Vancouver, Christ Church (in progress; 4/61); and Denton, University of North Texas, Winspear Hall (due 2008).

Richard Kassel

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WOOD PIPES

Wood has been used in the making of organ pipes for centuries. Most builders and organists agree that the tonal qualities that come from wood, while difficult to describe, have a special function within the instrument. Contemporary organbuilding does not use a high percentage of wood pipes as compared to metal pipes, and the ratio will vary from builder to builder and from organ to organ.

While some pipe organs have been built with no wood pipes, the only organ with all wood pipes is the famous Esajas Compenius organ (1609), now located at Hillerød, Denmark, Frederiksborg Castle. Even its tiny one-rank Mixture is all wood; the instrument is a tour de force in wood pipe–making. In the nineteenth and early twentieth centuries, it was common to make many ranks of pipes in wood, including the Melodia, Lieblichgedeckt, Stopped Diapason, Flauto d'Amore, Tibia, Flute Triangular, and Concert Flute. Even ranks of strings and diapasons were occasionally made of wood, and the percentage of wood pipes in this era might exceed 25 percent of the total pipes in the organ.

Wood remains as an optional material for the organbuilder to use as the situation warrants. Current usage of wood for pipe-making focuses on a few areas: (1) the 16' stopped Flute in the Pedal, although smaller instruments may use metal; (2) a Holzregal (Ger., wood Regal), a rank of reed pipes with wood resonators; and (3) a Holzgedackt, a stopped wood flute. The 16' Pedal reed may have wood resonators, but this is far from universal. There are occasions when unusual divisions or ranks are made from wood (Principals, open Flutes, etc.).

Current usage of wood pipes is usually aimed at achieving a noticeable difference in sound for a particular rank or series of ranks from the overall sound of metal pipes. The use of wood for pipes gives rise to several different tonal characteristics. Where a strength of fundamental and fullness of tone is needed in 16' Pedal ranks, the thick sturdy walls of a wood Subbass or Posaune provide a firm bass line for the organ. The thicker the wall, the firmer and more powerful the fundamental can be made, perhaps at the loss of the clarity provided by upper harmonics. When wood pipes are used for manual ranks, it is not always for the fullness of the fundamental, but rather for an overall difference in the tonal quality quite apart from that supplied by metal pipes. Hardwoods produce a sound that is usually precise, clear, and sometimes very chiffy; this clarity of line and promptness of speech may be enhanced or subdued by the voicing and wind pressure used. Softwoods (pine, fir, etc.) give a more relaxed tone, somewhat indefinite in pitch and mellow.

When choosing a type of wood based on the tone desired, the organbuilder must always consider how that wood will react to changes in humidity and temperature in the organ. Tuning problems limit the use of wood pipes, since they seem to go their own way in pitch when compared to the metal pipes. Some wood pipes stay in tune very well, while others float off pitch. This may have its own charm and musical usage in the right hands.

Hundreds of types of wood have been used to make organ pipes, and some woods have come and gone as musical tastes change. Exotic woods have been used, but their high price was more an indication of scarcity than stability, as the wood warped and split and left the pipe speechless. Recent experiments with high-grade plywood indicates that its materials are very useful in the construction of wood pipes. Some plywoods are far more stable than many solid woods; the ability of plywood to resist splitting and cracking makes it highly suitable for pipe construction. Most importantly, the sound of the finished pipe is indistinguishable from that of solid wood. Some builders would not use plywood for pipes because of the stigma against such a material, but many others have done so for many years with considerable success.

The United States once had a prodigious industry in harvesting magnificent large-scale woods of premium quality. A very large pipe organ from the early part of the twentieth century will usually have 32' pipes made from awe-inspiring pieces of lumber, 2" to 3" thick, 2' wide and 30' long. Such wood is quite rare now and of incredible price, but the client and builder still have access to such lumber. America will not run out of wood, but its availability in the quality and size needed is another issue.

CHARLES HENDRICKSON

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WORLD'S FAIRS AND EXPOSITIONS

By the late eighteenth century, scientific discoveries and an attitude less guided by religious belief had led to the beginning of the industrial age. The latest developments in commerce were represented in exhibits devoted to a particular industry, state, or nation. Along with beautiful architecture, decoration, and artwork, new machines were displayed to intrigue audiences and convince them of the superiority of their age. These well-attended events often featured at least one important organ or a gathering of organbuilders hawking their wares, offering the latest in pipemaking, actions, and wind supply to potential buyers.

The Paris industrial exhibitions (there were eleven between 1798 and 1849) were the first to draw international attention. ARISTIDE CAVAILLÉ-COLL first participated in the 1839 event; his instrument had a single wind source that divided into individual pressures for different pipes. He played a more significant role in the city's Expositions Universelles that succeeded the industrial exhibitions (from 1855). At the 1867 exposition, Cavaillé-Coll provided an organ for a neogothic church built in the new Parc des Buttes-Chaumont, which surrounded the main building. The park included Egyptian temples, a one-room schoolhouse, a replica Tunisian palace, lighthouses, kiosks, trophy cases, a view of an amusement park, and restaurants. In this context, the church became what Chandler called "a fair exhibit" rather than a place of worship, particularly with its potpourri of altars and other pieces in every style since the twelfth century. Much criticized by those who favored the old exposition model, the 1867 event served as a precursor of less overbearing (i.e., more entertainment-oriented) expositions to come.

Cavaillé-Coll was more fortunate in his organ for the 1878 Exposition Universelle, built for the theater of the Trocadéro Palace (4/79; over 70 tons). This instrument was rebuilt and electrified by the Victor GONZALEZ firm for Chaillot Palace at the 1937 Exposition Internationale in Paris, then restored and moved to Lyon (Ravel Auditorium, 1977; now 4/81). Cavaillé-Coll also built a smaller instrument (2/12) for the 1878 exposition; it was reused during the 1889 exposition, and sold to Rouen, Institution Joui-Lambest. Cavaillé-Coll's successor, Charles Mutin, produced an organ for the 1900 exposition; this instrument eventually went to the Moscow Conservatory (3/62).

Joseph MERKLIN, Cavaillé-Coll's major French competitor, also produced instruments for the Paris Expositions Universelles. His firm, J. Merklin-Schutze, built an organ for the Belgian pavilion at the 1855 exposition (3/33); it was given a first prize and Merklin received a knighthood. He also installed an early electro-pneumatic instrument for the 1891 exposition (4/74), later installed at Valenciennes, Notre Dame du St. Cordon. Strangis and Yollant restored the instrument to as close to the original Merklin as possible (1989–94)—an early example of Romantic organ restoration. Other builders involved in continental European expositions were E. F. WALCKER (Barcelona, Palacio Nacional Montjuich, 1929; 5/131; reb. OESA, 1960s) and CASAVANT FRÈRES (Anvers, Belgium, 1930; grand prize).

The British picked up on the industrial exposition concept (Free Trade Bazaar, London, 1845; Exhibition of British Manufacturers, Birmingham, 1849), but their most significant contributions to the genre began with London's Great Exposition, at the so-called Crystal Palace (Hyde Park, 1851; building reerected in Sydenham, 1854; destr. by fire, 1936). Several British builders were present—notably, GRAY AND DAVISON (4/60), William HILL (2/16; to Barnsley, Pitt Street Methodist, later to Sandy, Baptist Church; rest. Miller, 1983–85; now 3/45), and Henry WILLIS (3/70; Barker key action, first use of thumb pistons for preset combinations). M. Ducroquet, the only French organbuilder represented (Cavaillé-Coll was absent), showed a well-received instrument (2/20; BARKER LEVER, free reeds, Flute harmonique). Of the most significant German builders, Walcker was notable in his absence; the only German representative, the SCHULZE firm, was included because of Prince Albert of Saxe-Coburg, organizer of the exposition. Edmund Schulze brought an "old-fashioned" instrument (2/16): mechanical action, wedge bellows, no swell or combination actions; the only genuine innovation was the concave pedalboard. But the Schulze was so well voiced, the disposition so well laid out, and the Lieblichgedeckt stop so attractive, that English customers and builders made it the sensation of the organ section. Edmund and his brothers soon began nearly thirty years of successful installations in the United Kingdom (Armley, Doncaster, Harrogate, Hindley, Leeds). Numerous harmoniums from France and Belgium were on display, as were mechanical barrel organs (using pinned cylinders) made by BRYCESON and Gray and Davison.

The U.S. organ-building industry tested the exhibition waters during Patrick Gilmore's Peace Jubilee in Boston (1869), celebrating the end of the Civil War four years earlier. Among the myriad of singers, instrumentalists, cannons, and anvils was a HOOK AND HOOK organ (2/16). The firm's next exposition organ, for the main building of the Philadelphia Centennial Exposition (1876), was far larger: four manuals, thirty-nine stops, pedal (including 32' Bourdon stops), and pneumatic action, weighing in at over 30 tons. In a different gallery of the same building stood a Hilborne L. ROOSEVELT instrument (3/46); it had electro-pneumatic action, electrified wind supply, and adjustable combination pedals, and featured two remote divisions. More modest was the cabinet organ in the one-room Swedish Schoolhouse, meant to demonstrate the inclusion of music in all Swedish schools. More exotic was the Electro-Magnetic Orchestra in the Horticultural Hall; built by W. F. Schmoele of Philadelphia, it was a modern-day combination keyboard-ORCHESTRION, with electricity driving the sheets of music within rollers to produce the music. A double steam-powered engine provided the wind to the twelve "instruments" of the orchestrion; electromagnets helped relay the information from reading apparatus to sound source; performance speed was variable. Some saw this as the basis for a "giant orchestra," all produced on a successor to Schmoele's Electro-Magnetic Orchestra. The twentieth-century American THEATER ORGAN was the realization of this idea, albeit with different technology.

Gigantism, the belief that "bigger is better," pervaded many expositions, but nowhere more so than in the United States. Subsequent exposition organs focused on size more than technological subtleties. The Cotton Centennial Exposition in New Orleans (1884-85) featured a large PILCHER instrument, subsequently installed in the city's Church of the Immaculate Conception (reb. Moller, 1927–29; now 4/64, unplayable). The 1893 Columbian Exposition in Chicago featured a FARRAND AND VOTEY (4/63; to Ann Arbor, University of Michigan; reb. Æolian-Skinner, 1955; rest. Barden and Broome, 1990-93; now 4/122); there was also a two-manual by the same company and a three-manual by Henry Pilcher's Sons. (A four-manual by Carl Barckhoff of Ohio did not fit within the revised architecture of the Music Hall, to his great dismay and embarrassment; the organ was never installed.) The new century began with the Pan-American Exposition in Buffalo, New York (1901), where the Massachusetts builder Emmons Howard installed an instrument (4/84; tub.-pneum., adjustable combination, crescendo, sforzando pedals) that was being played in the Temple of Music when President William McKinley was assassinated there (6 Sept 1901). It was later purchased for the city of Buffalo and served as a concert hall instrument; it was dismantled in 1938.

The 1904 St. Louis Fair (officially the Louisiana Purchase Exhibition) outdid its American predecessors with its Murray M. HARRIS organ, designed by George A. AUDSLEY. The instrument (5/140; electro-pneum.) was in fact commissioned for the Kansas City Convention Hall, and was to be exhibited in St. Louis first. The commission was overly optimistic both in time allotted for building (it was not ready until a month after the exposition's opening) and financing (Harris overextended himself and had to surrender the firm to backers). The Festival Hall organ itself was a success, with featured recitals by the great French performer Alexandre Guilmant, who made a point of playing less well known repertoire. At the end of the exposition, the organ went into storage, as the Kansas City contract had been voided; it was eventually sold and installed at the Wanamaker Department Store in Philadelphia (1909-11; enl. 1917; store purchased by Lord and Taylor, 1997; now 6/408).

California presented two of the last U.S. expositions in which organs played a significant role. Less than a decade after its devastating earthquake, San Francisco hosted the Panama Pacific International Exposition (1915). The Festival Hall organ built by the Austin Organ Company (4/113) was moved to the Exposition (later Civic) Auditorium after the exposition's close (1917); restored by Schoenstein and Company (1984), it was severely damaged in the 1989 Loma Prieta earthquake. Its fate (possibly as an outdoor instrument) continues to be debated in the local organ community. At the same time as the San Francisco event, San Diego's Balboa Park was the site for the Panama-California Exposition. Its Spreckels Organ Pavilion also housed an Austin instrument (rest. 1981; 4/72; extant); the pavilion and its instrument fulfilled a similar role at the city's 1935 California-Pacific International Exposition.

Coover offers a list of expositions, world's fairs, and similar events with cross references to past and present-day instrument collections.

Richard Kassel

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WULFSTAN OF WINCHESTER
(fl. late tenth century)

English cleric and author. In his metrical prologue to a poetic life of St. Swithun, Wulfstan makes reference to a large organ at the Old Minster in Winchester. According to Wulfstan's account, the organ contained four hundred pipes and required seventy strong men to operate its twenty-six bellows. Forty sliders, each perforated with ten holes, were drawn and returned by two monks "of harmonious spirit." McKinnon argues that the hyperbolic tendency of Wulfstan's style and the small size of other organs in contemporary accounts undermine the organological accuracy of this description. The poem was composed between 984 and 1005, while Elphege II was bishop of Winchester. Elphege made numerous improvements to the Old Minster, and if the organ was installed toward the completion of the architectural changes, then it would date from about 994.

Kimberly Marshall

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WURLITZER

American piano- and organ-building firm of German origin. The Wurlitzer family of Saxony made and dealt

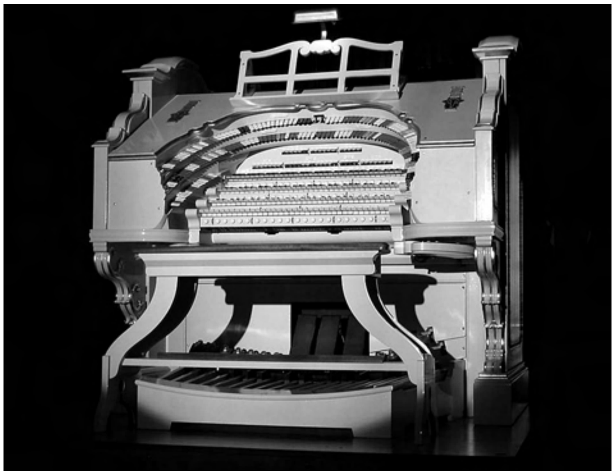

Fig. 85. Wurlitzer organ.

musical instrument. Its roots reach far back into the seventeenth century: Heinrich Wurlitzer (1595–1656), a maker of lutes, was followed by Hans Andreas Wurlitzer (b. 1701), Hans Andreas Wurlitzer II (1732–1799), and Hans Adam Wurlitzer, all violinmakers. Franz Rudolph Wurlitzer (b. Schöneck, Saxony, 30 January 1831; d. Cincinnati, 14 January 1914) came to the United States in 1853; operating as an instrument dealer in Cincinnati, he began the importation of German pianos in 1856. In 1881 he began to build pianos bearing the Wurlitzer name. In 1872 he was joined by his brother Anton, thus forming the firm of Rudolph Wurlitzer and Brother, and in 1890 incorporated the firm under the name Rudolph Wurlitzer Company.

In 1899 Rudoph's oldest son Howard Eugene (1871–1928) joined the firm as its business manager, taking note of the increasing popularity of automatic musical instruments. With this in mind, in 1909 the firm purchased the DeKliest Musical Instrument Works in North Tonawanda, New York, and in 1919 acquired the Melville-Clark Piano Company of DeKalb, Illinois. Rudolph Henry Wurlitzer went to Berlin in 1891 to study the violin with Emanuel Wirth and acoustics with Herman Helmholtz. On his return in 1894 he filled various administrative positions. Farny Reginald Wurlitzer (1883–1972) provided practical and technical knowledge, having apprenticed with various European makers, particularly Phillips & Söhne.

In the 1880s Wurlitzer was a leading distributor for the Regina Music Box Company, which at the request of Wurlitzer had equipped their product with coin slots. In 1899 Wurlitzer produced the Tonophon, an electrically driven piano actuated by a cylinder pinned to play ten selections and equipped with a coin slot. This instrument led to the production of other coin-operated music machines, and eventually to the coin-operated phonograph, or jukebox.

In the days of silent movies, the THEATER ORGAN added dramatically to the cinematic experience by reenforcing the action shown on the screen by appropriate music. Wurlitzer acquired the Hope-Jones Organ Company of Elmira, New York, in 1910. Working with Robert HOPE-JONES, it produced the Wurlitzer Hope-Jones Unit Orchestra in 1911; three years later it bought out Hope-Jones's patents. Wurlitzer pipe organs became so associated with theater music as to give rise to the epithet "Mighty Wurlitzer," applied to such instruments as the organ at New York, Radio City Music Hall, and the Berkeley, California, Community Theater (for an illustration, see THEATER ORGAN). The last Wurlitzer theater organs were produced in 1943—like all manufacturers, the victims of talking pictures, the phonograph, and radio.

Wurlitzer also built harps (1909–30) and a vertical piano only thirty-nine inches in height, subsequently referred to as the first spinet piano. In addition to its piano line, Wurlitzer controlled a number of other piano trademarks and had several factories and retail stores in major northeastern cities. After buying the ÆOLIAN COMPANY in 1985, the Wurlitzer Company was in turn bought by the BALDWIN firm (1988) and Wurlitzer production moved to Baldwin facilities. Now under the management of the Gibson Guitar Company, Wurlitzer continues to produce spinet, console, studio, and grand pianos, all of which are made in South Korea. No organs are being produced.

See also **Electronic Organ**

JAMES HOWARD RICHARDS

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X

XYLOPHONE

A percussion stop found on theater organs. Like its orchestral prototype, it consists of a set of hardwood bars, graduated in size, with each bar suspended over a cylindrical metal resonator. The bars are struck by mallets actuated by an electric or pneumatic mechanism. Within a single instrument the stop is often playable in two forms: as a single stroke each time a key is pressed, or reiterating for as long as the key is held. It is usually found at 4’ pitch.

See also **Stop**

Edward L. Stauff

Y

YOUNG, THOMAS (1773–1829)

English polymath and music theorist. Born in Milverton, Somerset, on 13 June 1773, Young was an experimental physicist; after reading Giordano Riccati's work on the different extents to which the same weight will stretch brass and iron harpsichord strings of the same size, Young measured degrees of elasticity in various substances and showed that one property of light (or "interference," under certain circumstances) requires it to be considered a kind of wave. Together with Hermann von Helmholtz, a German physician and physicist, he proposed the Young-Helmholtz theory of color sensation—that the eye is sensitive to three primary hues, of which all colors are made—was an important advance in optics. In his later years Young translated part of the Rosetta Stone and published a dictionary of hieroglyphics. He died in London on 10 May 1829. An early paper by Young contains a section on musical temperament, in which he worked out a sophisticated scheme of irregular (well) temperament, noting that nearly the same effect could be obtained by simply tuning each of the six fifths C–G–D–A–E–B–F♯ "equally imperfect" (by smaller than pure by 1/16 Pythagorean comma, or less than 1.5 cents) and the other six pure. Some scholars refer to this rougher scheme as "Young #2"; others have noted its similarity to one by Francescantonio Vallotti (1697–1780), supposed worked out by 1728 and cited in a book by Jones. Young's temperaments are used by builders such as William Drake, Harrison and Harrison, and Lammermuir of East Lothian, Scotland (rest. 1792 H. Russell chamber organ, 1988).

See also **Tuning and Temperament**

Mark Lindley

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YPMA

Dutch family of organbuilders. Dirk Sjoerds Ypma (1813–after 1844) worked as an apprentice for Willem van Gruisen (1788–1834); he started his own business in Bolsward, Frisia (after 1834). Initially, his organs had technical problems, but by 1841 he had enough authority to be asked to judge the work of a colleague. In 1843, he and his brother Lodewijk Sjoerds Ypma (1823–1887) moved to Alkmaar, while a third brother, Eeltje Sjoerds Ypma (1819–1893), continued the Bolsward workshop. The main reason for the Ypmas' move to Alkmaar may have been their Roman Catholic background, which may have prevented their getting much trade in Protestant West Frisia. In 1843–44, Dirk restored the Hagerbeer/F. C. Schnitger organ at Alkmaar, Grote St. Laurenskerk.

After the restoration of the diocesan hierarchy in the Netherlands in 1853, many new churches were built, providing an important boost for the firm. Under

Lodewijk's leadership, Ypma became the most important Roman Catholic organbuilder in the North Holland province; between 1854 and 1887, the firm built around thirty-two organs. After Lodewijk's death, his widow Anna Elisabeth Lucas Ypma continued the business, aided by foreman Johannes Hilboesen, who left in 1895, presumably because Anna Ypma was not willing to marry him. In 1897 Jos. Vermeulen became the firm's manager; he entered into partnership with Anna Ypma in 1900 and continued the company under his own name after her death in 1902. (The Vermeulen firm was in turn absorbed by D. A. FLENTROP in 1998.)

Nearly all Ypma organs have two manuals (Hoofdwerk and Bovenwerk) with pull-down pedals; only in Westwoud was a third manual (a Rugwerk) planned, but it never came to fruition. The typical Ypma Hoofdwerk contains eleven stops: 16.8.8.8.4.4.2-2/3.2.III/IV.II/IV.8; the Bovenwerk might have between five and seven: 8.8.(8.)(8.)4.4.(4.)2.(1.)8. Only four organs have an independent Pedal with two to five stops. After 1884, Ypma sometimes built a swell box. Since they were predominantly conceived for use in the Roman Catholic liturgy (for accompaniment and quiet interludes), Ypma organs tend to have a gentle rather than a big sound. Many Ypma organs survive; some have recently been restored to their original specifications (Westwoud, 1864, 2/23; Bleiswijk, 1871, 2/17).

JAN-PIET KNIJFF

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Z

ZACHARIASSEN

Danish organbuilding family, related to and involved with the MARCUSSEN firm. Johannes Lassen Zachariassen (b. 1864; d. 24 Feb 1922) was the great-grandson of Jürgen Marcussen (1781–1860), who started building organs around 1806 and founded an organ-building firm with Andreas Reuter (1798–1847) in 1821 (in Åbenrå, Denmark, from 1830 on). Jürgen formed Marcussen and Son with Jürgen Andreas Marcussen (1816–1900) in 1848; Jürgen Andreas became sole proprietor after his father's death. Johannes Lassen Zachariassen apprenticed with and worked for his uncle Jürgen Andreas Marcussen; in the 1880s, however, he went to Finland to become foreman at a shop run by another uncle, Jens Alexander Zachariassen (b. Broager, Denmark, 24 May 1839; d. Uusikaupunki, Finland, 4 June 1902), who had gone to Finland to install Marcussen organs and then set up his own firm in 1865. Jens Alexander expanded his business by selling pianos and nonmusical items; but his business suffered when Johannes Lassen was recalled to Åbenrå in the 1890s. After Jürgen Andreas's son Hartwig Alexander Marcussen (1859–97) died, Johannes Lassen was made a Marcussen partner; by 1902, he was director of the firm.

Initially, Johannes Lassen continued the firm's reliance on classical tonal philosophies; but, in keeping with the times, he developed late Romantic instruments with an emphasis on foundation stops. The firm also shifted from mechanical action with slider-chests to tubular-pneumatic action with cone-chests. A typical Marcussen organ was built for the Schmilau (Ratzeberg) chapel in 1905–6 (2/6); in 1979, it was given to the Berlin Museum. This organ, with its Töpfer scalings, was the kind of instrument that would later be criticized by organ reformers; yet despite its small size and disposition it is ideal for the late Romantic repertoire. (Marcussen also introduced electro-pneumatic actions at this time.)

Upon Johannes Lassen's death, his son, Sybrand Zachariassen, born 18 July 1900, assumed leadership of the firm, which had grown into an extensive business following World War I. By this time the ORGAN REFORM MOVEMENT had begun in Germany. Sybrand Zachariassen was among the first in Scandinavia to recognize these principles and to put them into practice, eventually producing instruments with eclectic dispositions based on classical principles. Beginning with the rebuilding of the organ in Copenhagen, Holmens Church (1924), Sybrand took Marcussen and Son in neoclassical directions, producing the firm's first organ built with a RÜCKPOSITIV (1929); a mechanical slider-chest organ (1930); a WERKPRINZIP organ with three divisions and pedal (1932); and an organ with each division enclosed separately. Mechanical action eventually replaced pneumatics completely; after World War II, slider-chests were used in all Marcussen instruments. In 1954, Sybrand gave a lecture at the Second International Convention for Catholic Church Music that touched off a long-simmering reform movement in Austria and other Catholic organ-building regions. He built notable instruments in Sweden, Denmark, and the Netherlands. His last instruments included Rotterdam, Grote Kerk, transept organ (1959; thirty-one stops), Halsingborg, Sweden, Mariakyrkan (1959; forty-nine stops); and Stockholm, Storkyrkan (1960; fifty-three stops). He also did more faithful restorations than his predecessors.

After Sybrand's death; his son Sybrand Jürgen Zachariassen took over management. After restoring the organ in the Grote Kerk, Haarlem, Marcussen and Sons shifted to building large tracker instruments with responsive touch in Copenhagen (1965), Linz (1968), Lübeck (1970), and Rotterdam, Grote Kerk (1973; eighty-five stops), perhaps the most important Marcussen project in recent years. The Nieuwe Kerk organ in Amsterdam (rest. 1981) is the largest extant instrument with spring-chests. Under Sybrand Jürgen, the firm has expanded markets to Israel, Japan, and the United States

RICHARD KASSEL

ROBERT CAVARRA

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ZARTFLÖTE

A term first used in the early 1800s by Tobias Turley for an open wooden Flute stop of 8' pitch and delicate (Ger. *zart*) tone. In the late 1860s Edmund Schulze used the term for a small-scale conical metal stop with a wooden bass; one source described it as an extremely soft and refined Flute, while another source called it a small-scaled Gemshorn. The stop was reinvented again in 1896 by J. W. Whiteley as a refined Quintaten, constructed of cylindrical metal pipes with wooden stoppers and harmonic bridges, as shown in the accompanying illustration by George A. AUDSLEY.

See also **Stop**

EDWARD L. STAUFF

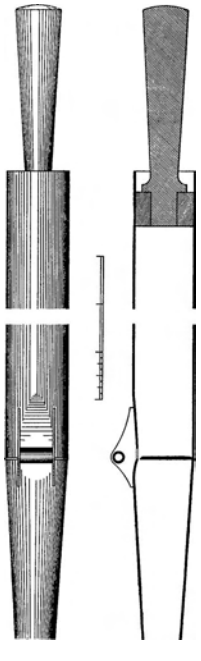

Fig. 86. Zartflöte.

ZAUBERFLÖTE

A stopped Harmonic Flute stop of 8', 4' or 2' pitch, invented by Michell and Thynne of London and introduced by them in an organ built for the London Inventions Exhibition of 1885 (later moved to Tewkesbury Abbey). Its name means "magic flute," after the opera by Wolfgang Amadeus Mozart. A stopped harmonic pipe has a length twice that of a normal open pipe speaking the same pitch. A small hole is pierced partway up the body of each pipe. Normal stopped pipes of the usual length are used below 4' C. The tone of the Zauberflöte has been described as full, liquid, and pure, with a "suspicion of stringiness".

See also **Stop**

EDWARD L. STAUFF

ZIMBEL

(Ger.; Fr., *Cymbale*; Eng., *Cimball*, *Cymball*; It., *Cembalo*; Sp. *Cimbala*). A high chorus MIXTURE stop, separated from the BLOCKWERK; often identical with the SCHARF until the beginning of the eighteenth century, when *Cymbale* (Fr.) became its common name (hence, *Zimbel*). While a very important Renaissance and Baroque stop, the definition remains allusive. Some Zimbel stops include the Tierce (Terz); Praetorius mentions the 15.17.19 "large Zimbel," i.e., a Mixture III comprising the octave, tenth, and twelfth above the fundamental. Adlung defines the Zimbel thus, while he treates the Scharf as limited to octaves and fifths. On the other hand, the French classical Cymbale used octaves and fifths, with ranks breaking twice per octave; it was originally part of the fourniture. Praetorius classifies five types, including the Baroque "repeating Zimbel" (usually one octave rank) and the "Zymbel" (two octave ranks). The missing Terz in these two Zimbel stops may have resulted from problems with meantone tuning; the well-tempered tuning of the mid-eighteenth century allowed the reintroduction of thirds. The repetition or breaking of octaves and fifths helps make the bass clearer, aiding polyphonic muscial structures in the music; the higher parts of the Zimbel usually have fewer repeating pipes, to avoid their dominating the lower parts, even going beyond the limits of human hearing.

See also **Cymbal/Cymbale**

FERDINAND J. DE HEN

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ZIMBELSTERN/CYMBELSTERN

(Ger. cymbal star; also spelled *Cimbelstern*, *Zymbelstern*) An older toy stop, one of the few still used by organbuilders today. It consists of a metal or wooden star (usually visible on the facade of the organ case, often at the top) to which a wind-driven wheel (not visible) is attached; on this wheel, several small untuned bells are mounted. When the stop is engaged, the wheel and therefore the star rotates, producing a continuous tinkling sound along with the optical effect. If the entire apparatus is not visible to the audience, it may or may not have a star shape. The Zimbelstern was most common in northern Europe, Germany in particular, from the turn of the sixteenth through the eighteenth centuries. Early confirmed examples include Hamburg, Katherinenkirche (Stellwagen, 1543) and Münster Cathedral (Lampeler van Mill, late 1580s). In central and southern Germany, especially Thuringia, the stop was included as late as the 1830s.

After 1700 the bells were sometimes tuned to particular notes, such as a major chord or keys. Jacob Adlung (1758) referred to their being tuned in two keys (C and G, "because most chorales can be sung in these keys"), and invented a special type usable in all keys. Later versions used tuned metal plates (a kind of CELESTA) instead of bells In the front of some Spanish organ facades have their driving-wheels "moved" by angels "blowing" against them (Cordoba Cathedral, late eighteenth century).

Mattheson indicates that the Zimbelstern was not used in everyday services but reserved for feast days because of its special qualities. He and ADLUNG associate it with the choral chant, later the chorale melody. Northern German sources support this, adding that in some churches the faithful had to pay for if they wanted the Zimbelstern to be played. There is no support for its being used in the performance of preludes and fugues or other purely instrumental organ pieces.

The same stop without the visible star may be called the *Glockenzimbel* or *Glockenakkord* ("bell chord"). *See also* **Percussion Stops; Stop**

EDWARD L. STAUFF
CHRISTIAN AHRENS

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ZIMMER

American organ-building firm. The founder, Wilhelm Zimmer (b. ?Aldorf, Germany, 5 Feb 1911) worked with D. A. FLENTROP, B. Pels en Zoon, van Leeuwen, Georg Stahlhuth, and Vermeulen in the years prior to World War II; he returned to B. Pels (1946–51), then emigrated to South Africa, where he served in various capacities for R. Mueller of Kapstadt, establishing a branch in Johannesburg (1953) and becoming a partner in a new Mueller Orrelbouers (1957). In 1963, Zimmer emigrated to the United States, establishing his own firm in Charlotte (and later, Pineville), North Carolina. He applied his experience in the burgeoning neobaroque and ORGAN REFORM MOVEMENTS, committing to building new tracker action instruments rather than rebuilding, and with a careful consideration of acoustic environment. In 1980, Zimmer retired; the firm was taken over by his son Ben A. Zimmer, who is now partnered with Bernard Zimmer.

Among the firm's instruments are Indianapolis, Faith Presbyterian Church (2/22); Oklahoma City, Cathedral of Our Lady (1993; 3/32); St. Louis, Chapel of the Cross Lutheran Church (2000; 3/32); Conyers, Georgia, First Baptist Church (forty-four stops); River Forest, Illinois, Concordia University (fifty-five stops); Philadelphia, Ascension Lutheran Church, Luther Seminary Chapel (thirty-one stops); Long Beach, California, First Lutheran (forty-seven stops); and Bloomfield Hills, Michigan, St. Hugo of the Hills (4/58; unusual design, painted pipes).

RICHARD KASSEL

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ZINC

A metal widely used in the construction of organ pipes. Even though it does not share the deserved exalted reputation of tin-lead combinations (PIPE METAL, SPOTTED

METAL), zinc has been used for more than a century for making the larger pipes in many instruments. The largest metal organ pipes in the world are of zinc 5/16" thick; but it cannot be used for pipes much shorter than 2' in length.

Zinc cannot be processed by the organbuilder; it must be purchased in sheets of varying thickness from rolling mills. In Europe, the zinc is softer and of a high purity. American zinc is generally harder, from the purposeful inclusion of other metals. When fresh from the rolling mill or polishing machine, zinc has a shiny, tinlike appearance, but it soon starts to look smoky or mottled and eventually turns grey; this results from a process of crystal growth going on inside the metal. Eventually in hard zinc, these crystals reach the surface of the metal and create a speckled or mottled appearance; the crystal specks are visible after about ten years, and usually grow to full size within about twenty years.

A look into any American organ built before 1950 reveals that all of the zinc pipes have completely crystallized and that the color of the pipe is dark and speckled. A twisting of the zinc metal will produce a crackling, scream, or shimmer as these crystals are broken away from each other, and the pipes appear to be hard or brittle. Fortunately, the tone of the old zinc pipes is not audibly changed by this crystallization. Many old tracker organs are restored with their 120-year-old zinc pipes kept intact and speaking like new, or better.

Most zinc pipes receive a coat of lacquer. The lacquer may be clear if the pipes are used in the FACADE, but it appears that no clear lacquer is yet available that will fix the appearance of the underlying zinc, and after some years the once shiny zinc will become dark and irregular in appearance. Many zinc pipes are given a coat of opaque metallic lacquer so that the metal is totally hidden.

Zinc is used in organ building because of its low cost, ease of fabrication, and acceptable if not thrilling tonal quality. Builders would never claim zinc to be superior to a tin-lead alloy, but only a very few clients could afford to purchase a polished tin-lead Prestant 16', and not many more can even afford the luxury of an 8' Prestant of 90 percent tin, polished, with long feet and a fancy mouth treatment. The economics of organ building have kept zinc alive as a widely used metal, but in the face of a decline in the number of mills supplying the material, other materials such as copper, aluminum, and wood have found growing acceptance; the next decade or so may see changes in the type and amount of zinc used in organ building.

CHARLES HENDRICKSON

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ZINK/CORNET/CINQ

A reed (sometimes compound flue) stop of 4', 2' or 1' pitch, imitative of the obsolete Renaissance shawm-like instrument. Its brassy, penetrating timbre is particularly effective in emphasizing Pedal lines, whether playing hymn tunes or in counterpoint with the manuals.

See also **Stop**

ZÜSS

SEE SUISSE, HANS

ZWITS

SEE SUISSE, HANS

ZWOLLE, HENRI ARNAULT (ARNAUT) DE

SEE ARNAULT (ARNAUT) DE ZWOLLE, HENRI

Contributors

VICTORIA ADAMENKO
Pensacola, Florida
Russia

CHRISTIAN AHRENS
Ruhr-Universität Bochum, Germany
Free Reed
Kratzenstein, Christian Gottlob
Percussion Stops
Toy Stops
Zimbelstern/Cymbelstern

JONATHAN AMBROSINO
Boston, Massachusetts
Aeolian Co.
Aeolian-Skinner Organ Co.
Barden, Nelson C.
Player Pipe Organ
Skinner, Ernest M.
Welte Organ Company

JEAN-RENAUD ANSART
Carlier, Crespin
Joyeuses, Jean de L'Epine

PARLEY BELNAP
Brigham Young University, Provo Utah
Ridges, Joseph H.

JESUS BERNAL
National Music Conservatory, Mexico City, Mexico
Mexico

JACK BETHARDS
Schoenstein Organ Company
Schoenstein

DAVID L. BEYER
NORDLIE, JOHN F.
STEPHEN BICKNELL
Royal Academy of Music, London, UK
Michell, Carlton C.

BERNHARD BILLETER
University of Zurich
Switzerland

JIM BISHOP
Hook

JOHN BISHOP
Organ Clearing House, Lexington, Massachusetts
Care and Maintenance of Pipe Organs
Organ Clearing House
Purchasing an Organ
United States, Future of the Pipe Organ in

ZDRAVKO BLAZEKOVIC
/international Repertory of Music Literature, City University of New York
Croatia

DANIEL BOOMHOWER
Princeton University, Princeton, New Jersey
Gurlitt, Wilibald

GEORGE BOZEMAN, JR.
Bozeman Organ Company
Bozeman, George, Jr.

DOLORES BRUCH
University of Iowa
Fritzsche, Gottfried

DOUGLAS E. BUSH
Brigham Young University
Abbot and Sieker
Aquincum Organbuilder Company
Barbier, Nicolas
Beck
Becker
Bode, Harald
Bonatti
Bossard
Breisiger, Peter
Cahman
Callido
Casparini
Coulter, Kenneth
D'Argillières
De Héman
Donati
Ebert, Jörg
Echevarría
Engler
Füglister, Hans J.
Gartner
Haas, Friedrich
Hammer
Haskell
Hauser, Armin
Hildebrandt
Holzhay
Jahnn, Hans Henry
Juget-Sinclair
Kaschendörf, Stephan
Kemper
Le Picard
McManis, Charles
Mundt, Johann Heinrich
Nollet
Pescheur
Richards, Fowkes
Rodensteen
Samber, Johann Baptist
Sauer, Conrad
Sauer, Wilhelm
Scheibe, Johann
Schlag
Speissegger
Stark
Strand, Per Z.
Suisse, Hans
Tamitius
Thayssner, Zacharias
Tretzscher, Matthias
Vleugels
Vogt, Mauritius
Voit

ROMAN CANTIENI
Kantonal Schule, Chur, Switzerland
Felsberg

ARTHUR D. CARKEEK
Greencastle, Indiana
Beckerath, Rudolf von

ROBERT CAVARRA
Colorado State University
Marcussen
Phelps, Lawrence I.
Zachariassen

DOMINIQUE CHAILLEY
Daublaine-Callinet
Moitessier, Prosper-Antoine

SALLY CHERRINGTON BEGGS
Newberry College, South Carolina
Pedagogy

THOMAS CIMARUSTI
Uta*h Valley State College*
Agati
Antegnati
Blasi, Luca
Fachetti, Giovanni Battista
Klemm, Johann Gottlob
Prato, Lorenzo da
Serassi
Tamburini
Tronci

JAMES H. COOK
Birmingham Southern College, Alabama
Casavant Frères
Cavaillé-Coll, Aristide
France
Holtkamp

WILLIAM F. COSCARELLI
University of Georgia
Prestant

MICHAEL A. COX
New Zealand
Croft, George
New Zealand
Schantz
South Island Organ Company

CRAIG CRAMER
Notre Dame University
Brombaugh, John
Brunzema, Gerhard

JOANNE CURNUTT
Rochester, Minnesota
Andersen, Poul-Gerhard

DAVID DAHL
University of Oregon

Fritts, Paul
Pasi

HUGH DAVIES
Deceased
Electronic Organ
Experimental Organ
Salomon de Caus

FERDINAND J. DE HEN
University of Gent, Belgium
Arnault de Zwolle, Henri
Baroque Organ
Brebos
Brustwerk
Componium
Drehorgel
Fundamentum Organisandi
Keyboard
Langhedul
Low Countries
Mortier
Mouth Organ
Niehoff
Orchestrion
Pedaliter
Peteghem, van
Praetorius, Michael
Rückpositiv
Virdung, Sebastian
Vogler, Georg Joseph
Wagner, Johann Michael
Zimbel

ALASTAIR DISLEY
University of York
Grant, Degens and Bradbeer
Open Wood
Pipe
Pouch or Puffer Note Control
Schwimmer
Stop
Vogelsang/Nachtigall/Rossignol
Willis, Henry, “Father”
Windway

LYNN DOBSON
Dobson Organ Company
Action
Console
Dobson

BRIAN DOHERTY
Arizona State University
Agricola, Johann Friedrich
Chrismann, Franz X.
Merklin, Joseph
Riepp, Karl Joseph
Sorge, Georg Andreas
Thierry

JARED DONG
Sandy, Utah
Bond, Richard L.
Leavitt, Josiah

LYNN BUTLER EDWARDS
University of British Columbia
Stertzing
Wegscheider, Kristian
Westfield Center

JÜRGEN EHLERS
Berlin, Germany
Altes Land
Schnitger, Arp
Stellwagen, Friedrich
Trebs, Heinrich Nikolaus

PÁL ENYEDI
Liszt Ferenc Academy of Music, Budapest, Hungary
Hungary

JESSE ESCHBACH
North Texas State University
Balancier
Barker Lever
Carillon
Grand Choeur
Grand Jeu
Grand Orgue
Grand Plein Jeu
Jaeckel, Daniel J.
Jeu de Tierce/Cornet
Orage
Petit Plein Jeu
Plein Jeu
Récit
Tierce
Tirasse

QUENTIN FAULKNER
University of Nebraska
Adlung, Jacob
Liturgy
Töpfer, Johann Gottlob
Trampeli
Trost T. H. G.
Wagner, Joachim

JOHN T. FESPERMAN
Deceased
Chamber Organ
Flentrop, D. A.
Moore, David
Organ Reform Movement
Snetzler, John

CONTRIBUTORS

HANS FIDOM
Houwerzjil, The Netherlands
Periodicals

MARTHA FOLTS
Adrian College, Michigan
Doppio Pedale
Noack, Fritz
Ruggles, Charles M.

JOHN FOSS
Mount Olympus, Greece
Theater Organ

TINA FRÜHAUF
International Repertory of Music Literature, City University of New York
Bells
Gabler, Joseph
Israel and Palestine
Mauracher

ROLAND GALTIER
*Cliquo*t
Dallery

GERARD GILLEN
National University of Ireland, Maynooth
Ireland

JERZY GOLOS
Warsaw, Poland
Glowinski, Jan
Mielczarski, Mateusz
Poland
Sitarski, Józef
Sliwinski, Jan

LUIS GONZALEZ-CATALAN
St. Matthew's Episcopal Church, Pampa, Texas
Chile

RIMANTAS GUCAS
Vilnius, Lithuania
Lithuania

ANDRES GUNTER
Venezuela

WOLFRAM HACKEL
Dresden, Germany
Dähnert, Ulrich

CHRISTOPHER HAINSWORTH
Conservatoire de Musique, Béziers, France
Carlier, Crespin
Daublaine-Callinet
Joyeuses, Jean de
L'Epine
Moitessier, Prosper-Antoine

JOHN HAMILTON
University of Oregon, Emeritus
Ahrend, Jürgen
Aubertin, Bernard

HARRISON & HARRISON, LTD.
Durham, United Kingdom
Harrison and Harrison

KELVIN HASTIE
Sydney, Australia
Hill, Norman and Beard, Australia
Laurie, Stephen J.
Noad, Sydney T.
Pitchford and Garside
Pogson, Roger H.
Richardson, Charles
Whitehouse

WILLIAM HAYS
Deceased
Gonzalez, Victor
Isnard, Jean-Esprit

HARLES HENDRICKSON
Hendrickson Organ Company
Aluminum
Choir
Copper
Coupler
Great
Hendrickson Organ Company
Pedal
Stoplist
Winding
Wind Pressure
Wood Pipes
Zinc

HEATHER HERNANDEZ
Lutheran Church of the Master, Phoenix, Arizona
Alsace
Harmonic Stop

JAN JANCA
Tübingen, Germany
East Prussia
Lithuania

Mosengel, Johann Josua
Terletzki

CALVERT JOHNSON
Agnes Scott College, Georgia
Spain
Trompeta Real

JANE L. JOHNSON
Crab Orchard, Tennessee
En Chamade Reeds
Portugal

CLEVELAND JOHNSON
De Pauw University
Ems-Dollart Region
Tablature

MARTIN KARES
Union of German Organ Advisors, Karlsruhe, Germany
Durner, Charles F.
Engelfried, Franz Xaver
Tannenberg, David

KIM KASLING
College of St. Benedict, St. Johns University, Minnesota
Hencke, Johann

RICHARD KASSEL
New York, New York
Abbey, John
Action
Adema
Africa
Alberdi Recalde, Lope
Alternatim
American Theatre Organ Society
Aquincum Organbuilder Company
Asia
Audsley, George A.
Backfall
Basset Horn
Bavaria
Beard
Bellows
Bibliotheca Organologica
Boisseau
Boot
Bosch Bernati-Verí, Jorge
Bryceson
Bungboard
Burnett, Richard
Canada
Case
Central and South America
Cerveira, António Machado
Chair Organ
Chamber Music and Accompanying
Chest
Chiff
Cipri
Clairon/Clarion/Clarin
Classical Organ
Claviorgan
Cleat
Comma
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Compton, John H.
Concussion Bellows
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Instruments, Collections
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Lefèvre
Létourneau, Fernand
Lewis and Hitchcock
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Lobo, Heitor
Lowrey
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Manualiter
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Mechanical Organ
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Miter
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Mounted
Mouth
Müller, Christian
Mutin, Charles
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Richards, Emerson
Ripieno
Rohrflöte/Chimney Flute/Flûte À Cheminée
Rollerboard
Rollschweller
Romantic Organ
Rosales, Manuel J.
Run
Sá Couto, Manuel
Sauer, Wilhelm
Saxony
Schalmei/Chalumeau/Shawm
Schlick, Arnolt
Schlicker
Schuke
Schulze
Seventeenth
Sforzando
Shallot
Shove
Shudi, Burkat
Signal Organ
Silbermann, Johann Andreas
Silesia
Sixteen Foot
Slegel
Slider
Smith, Bernard, “Father”
Solo
Sound Effects
South Africa
Spitzflöte/Spire Flute/Flûte À Fuseau
Square
Steiner-Reck
Steinmeyer
Sticker
Stop Channel

Stopped Diapason
Stopped Pipe
Stuart
Stumm
Swallow's Nest
Swarbrick, Thomas
Swell
Taylor and Boody
Terletzki
Throat
Thuringia
Tibia
Toe
Tracker
Tremulant
Tromba
Trombone/Posaune
Trumpet/Trompette/Trompete/Trompeta
Tuba
Tubular Action
Tuning Fork
Twelfth/Nasard/Nazard/Nasat/Quint
Twenty-First/Septième
Unification
Unit Chest
United States of America
Unit Organ
Unit Stop
Unterwerk
Vater, Christian
Vegezzi-Bossi
Ventil
Verschueren
Viol/Viole
Viola
Viola da Gamba
Violoncello/Cello
Violone
Vox Angelica/Voix Angelique
Vox Humana/Voix Humaine/Voce Umana
Vulpen, van
Waldflöte
Walker
Warren
Water Motor
Wedge Bellows
Wender, Johann Friedrich
Werkprinzip
Willis Floating and Fisk Servopneumatic Levers
Windchest
Windtrunk
Wolff, Hellmuth
World's Fairs and Expositions
Zachariassen
Zimmer
Zink/Cornet/Cinq

J. J. KEELER
Deceased
Schweitzer, Albert

CHRISTOPH KEGGENHOFF
Speyer Cathedral, Germany
Eule
Führer
Gesellschaft der Orgelfreunde
Giesecke and Son
Glatter-Götz
Heuss
Laukhuff
Link Orgelbau
Mahler, Rémy
Rieger
Sandtner
Schumacher
Seuffert

DOROTÉA KERR
Instituto de Artes, Universidade Estadual Paulista, São Paulo, Brazil
Brazil

STEPHEN KEYL
Tucson, Arizona
Spiegel der Orgelmacher und Organisten

JAMES KIBBIE
University of Michigan, Ann Arbor
Czech Republic

DAVID S. KNIGHT
London, United Kingdom
Harris, Renatus

JAN-PIET KNIJFF
Aaron Copland School of Music, Queens College, City University of New York
Bader
Covelens, Jan van
Friederichs, Johann Caspar
Hess, Hendrik Hermanus
Hinsz, Albert Antoni
Knipscheer
Moreau, Jacob François
Periodicals
Schnitger, Franz Caspar
Smits
Ypma

ALEXANDER KOSCHEL
Ladegast Society, Friedrichshafen, Germany
Ladegast, Friedrich

GÜNTER LADE
Austria
Mathis

CONTRIBUTORS

ARTHUR LAWRENCE
Church of the Good Shepherd, New York, NY
American Guild of Organists
Bigelow, Michael L.
Dieffenbach
Frels, Rubin S.
Goodwin, Steuart
Hinners
Hradetzky
Kern
Klais
Mander
Metzler
Moller
Performance Practice
Reuter
Ruffatti
Steere, John W.
Visser-Rowland
Walcker
Wicks

JIM LEWIS
Pasadena, California
Harris, Murray M.

MARK LINDLEY
Istanbul Technical University
Cent
Fingerings, Historic
Just Intonation
Mentone Temperament
Pythagorean Intonation
Tuning and Temperament
Well Temperament
Wolf Fifth
Young, Thomas

CHRISTIAN LUTZ
Strasbourg, France
Garnier, Marc
Haerpfer
Koenig
Roethinger

JOHN MAIDMENT
Organ Historical Trust of australia, Camberwell, Australia
Australia
Dodd, Josiah E.
Fuller, Alfred
Organ Historical Trust of Australia
Sharp, Ronald W.
Smenge, Knud

KIMBERLY MARSHALL
Arizona State University
Blockwerk
Bourdon
Ctesibius
Cymbal/Cymbale
Georgius
Hydraulis
Iconography
Portative
Positiv
Positive
Theophilus
Tsuji, Hiroshi
Vitruvius
Wulfstan of Winchester

DENNIS P. MILNAR
Milnar Organ Company, Eagleville, Tennessee
Milnar

FREDERICK L. MITCHELL
Austin Organs, Hartford, Connecticut
Action

LAWRENCE MOE
University of California, Berkeley
Harrold, Greg

DANIEL MULLER
Dallas, Texas
Mexico

GEOFFREY MYERS
St. George, Utah
Scaling

RONALD G. NEWTON
New Zealand Organ Manufactory, Oamaru, New Zealand
Jenkins, Edgar H.

ORPHA OCHSE
Whittier College, California, Emeritus
Austin, John T.
Austin Organs Inc.

JOHN K. OGASAPIAN
University of Massachusetts
British Institute of Organ Studies
Erben, Henry
Geib, John
Hall, Thomas S.
Jardine
Midmer
Odell
Roosevelt, Hilborne L.

MICHAEL L. OHMAN
Brigham Young University
Hope-Jones, Robert

OLE OLESEN
Copenhagen, Denmark
Botzen
Brebus, Hans
Denmark
Frobenius, Theodor
Kastens, Lambert Daniel
Kjersgaard, Mads
Lorentz, Johan
Lund, Carsten
Maass, Nicolaus
Rodensteen

BARBARA OWEN
Newburyport, Massachusetts
Alley, Joseph
Appleton, Thomas
Biggs, E. Power
Enharmonic Organ
Fisk, Charles B.
Goodrich, William M.
Harrison, G. Donald
Holbrook and Ware
Johnston, Thomas
Long Compass
Morss, Richard P.
Organ Library
Reed Organ
Restoration
Simmons, William B. D.

V. JAY PANETTA
Wellesley College, Massachusetts
Bendeler, Johann Philipp
Compenius, Esajas
Coulement
Denis, Jean
Fabricius, Werner
Subsemitones
Werckmeister, Andreas

DONALD R. M. PATERSON
Deceased
Johnson

L. A. ESTEVES PEREIRA
Famalicao, Portugal
Portugal

STEPHEN L. PINEL
Organ Historical Society
American Organ Archives
Andrews, Alvinza
Beach, Giles
Corrie, Henry
Crabb, Henry
Davis, William
Earle, George W.
Ferris, Richard H.
Feyring, Philip
Hall, James
House, Garrett
Jackson, James
King, William
Lowe, John
Marklove, John G.
Niemann, Henry
Pomplitz, August
Redstone, William
Robjohn, Thomas
Roosevelt, Hilborne L.
Standbridge, John C. B.
Stein, Adam
Taws, Charles

PETER G. C. VAN POUCKE
University of Gent, Belgium
Acoustics
Aliquot

JOHN POWER
Glasgow, Scotland
Byfield
Gern, August
Lewis, T. C.
Mirrlees
Spotted Metal
Toe Board

DAVID REED
Theater Organ

ROBERT J. REICH
Andover Organ Company, Methuen, Massachusetts
Andover

JAMES HOWARD RICHARDS
Waco, Texas
Alexandre
Baillie-Hamilton, James
Baldwin
Carhart, Jeremiah
Debain, Alexandre François
Estey
Farrand and Votey
Grenié, Gabriel-Joseph
Kimball, W. W.
Mason and Hamlin
Packard Organ Company
Prescott, Abraham
Prince, George A.
Regal (I)

Sawyer, John W.
Seraphine
Snell
Thomas Organ Company
Titz, Peter
Vocalion
Wheatstone, Charles
Wilcox and White
Wurlitzer

TIM RISHTON

Stord/Haugesund University College, Norway
Scandinavia

GEORGE RITCHIE

University of Nebraska
Bedient, Gene R.

GODWIN SADOH

Nigeria

ALFRED F. SEFL

Editor Emeritus, The Glue Pot, San Francisco, California
Blower
Cipher
Diaphone
Theater Organ
Wind Gauge

PETE SIEKER

Abbot & Sieker
Abbot and Sieker

DAVID SMIT

Johannesburg, South Africa
Barker Charles S.
Bonavia-Hunt, Noel A.
Calcant
Celeste
Chorus
Chorus Reeds
Huss, Berendt
Languid
Pitch and Pitch Standards
Scherer
South Africa
Trebs, Heinrich Nikolaus

JOHN E. SPERLING

Wicks Organ Co.
Action
Windchest, Direct-Electric

EDWARD L. STAUFF

Institute for Pipe Organ Research and Education, Charlottes, Vermont
Aeoline
Bärpfeife
Bauerflöte
Bifara
Bird Whistle
Blockflöte
Bombarde
Cahpana
Celesta/Chrysoglott
Celeste
Celestina
Chimes
Choralbass
Clarabella
Clarinet
Clarinet Flute
Compensating Mixture
Corno Dolce
Corno Flute
Cornopean
Cremona
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Doppelflöte
Drum Pedal
Dulciana
Dulzian
Erzähler
Euphone
Flûte À Pavillon
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Harmonica
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Hohlflöte
Horn Diapason
Keraulophone
Kinura
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Lieblichgedeckt
Marimba
Melodia
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Nachthorn
Nason
None/Twenty-Third
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Physharmonika
Piffaro
Post Horn
Progressio Harmonica
Ranket
Rauschpfeife/Rauschquinte/Quartane
Resultant/Acoustic Bass/Gravissima
Salicional
Schwiegel
Seraphonpfeife
Sifflöte
Sordun
Spillflöte
Stop
Tertian/Terzian
Unda Maris

Viola d'Amore/Viole d'Amour
Viola Pomposa
Waldhorn
Wienerflöte
Xylophone
Zartflöte
Zauberflöte
Zimbelstern/Cymbelstern

GEORGE B. STAUFFER
Rutgers University, New Jersey
Anches
Plenum

NICHOLAS J. THISTLETHWAITE
Cambridge, United Kingdom
Bishop
England
Fonds
Gauntlett H. J.
Gray and Davison
Hill, William
Hill, Norman and Beard
Norman and Beard
Willis, Henry, "Father"

MARCO TIELLA
Accademia di Musica Antica, Rovereto, Italy
Foundation Stops
Italy
Mixture
Mutation
Nightingale
Scharf/Scharff/Sharp/Scherp/Acuta
Sesquialtera
String
Tremulant
Voicing

ELIZABETH TOWNE SCHMITT
Rolla, Missouri
Gärtner, Gottlieb Friedrich
Gratian, Joseph
Metz, William
Pfeffer, John G.
Pilcher
Schuelke, William
Tellers

ANDREW UNSWORTH
Cathedral of the Madeleine, Salt Lake City, Utah
Composers and the Historical Organ

ROSS UPDEGRAFF
Evanston, Illinois
Sipe, Robert L.
Wilhelm, Karl

DIETER UTZ
Kuhn Orgelbau, Maennedorf, Switzerland
Kuhn

JAMES L. WALLMANN
*Pleasant Hill, Californi*a
Bätz
Bédos de Celles, François
Havingha, Gerhardus
Hess, Joachim
Heurn, Jan van
Maarschalkerweerd
Silbermann
Witte

JAMES WELCH
Palo Alto, California
Brazil

JAMES WYLY
Oaxaca, Mexico
Tafall y Miguel, Mariano

MAZIMILIAN ZWEIMÜLLER
Seewalchen am Attersee, Austria
Austria
Egedacher
Herz, Daniel
Römer

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DOUGLAS E. BUSH is Professor of Music at Brigham Young University in Provo, Utah. He has conducted numerous workshops and master classes on organ literature and church music and has published widely on the subject. He has given concerts in the United States, Mexico, and Europe and has been a featured soloist in several concert series.

RICHARD KASSEL is a composer and scholar who lives in New York. He edited *Baker's Dictionary of Music* and *Webster's New World Dictionary of Music*, and edited and wrote the introductory essay for *Harry Partch, Barstow: Eight Hitchhiker Inscriptions from a Highway Railing at Barstow, California (1968 Version)*. He contributed to the *Encyclopedia of the Renaissance* and *The Harpsichord and Clavichord: An Encyclopedia*.

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